

## All India Aakash Test Series for NEET-2025

**TEST - 3 (Code-I)**

Test Date : 07/01/2024

**ANSWERS**

1. (4)	41. (3)	81. (4)	121. (2)	161. (2)
2. (4)	42. (1)	82. (1)	122. (4)	162. (1)
3. (2)	43. (4)	83. (2)	123. (3)	163. (3)
4. (2)	44. (2)	84. (2)	124. (2)	164. (2)
5. (3)	45. (3)	85. (3)	125. (3)	165. (1)
6. (1)	46. (3)	86. (2)	126. (2)	166. (4)
7. (2)	47. (3)	87. (3)	127. (4)	167. (4)
8. (1)	48. (2)	88. (2)	128. (1)	168. (3)
9. (1)	49. (3)	89. (4)	129. (2)	169. (2)
10. (1)	50. (1)	90. (1)	130. (3)	170. (1)
11. (3)	51. (4)	91. (4)	131. (2)	171. (1)
12. (1)	52. (3)	92. (4)	132. (4)	172. (2)
13. (1)	53. (1)	93. (4)	133. (2)	173. (1)
14. (1)	54. (2)	94. (3)	134. (3)	174. (2)
15. (3)	55. (1)	95. (1)	135. (1)	175. (3)
16. (1)	56. (4)	96. (2)	136. (2)	176. (4)
17. (4)	57. (2)	97. (3)	137. (3)	177. (3)
18. (2)	58. (2)	98. (3)	138. (2)	178. (3)
19. (3)	59. (4)	99. (4)	139. (4)	179. (3)
20. (1)	60. (1)	100. (2)	140. (1)	180. (4)
21. (4)	61. (4)	101. (3)	141. (3)	181. (1)
22. (4)	62. (3)	102. (2)	142. (2)	182. (2)
23. (1)	63. (4)	103. (4)	143. (4)	183. (1)
24. (4)	64. (2)	104. (3)	144. (3)	184. (4)
25. (2)	65. (1)	105. (2)	145. (4)	185. (1)
26. (1)	66. (4)	106. (1)	146. (2)	186. (3)
27. (1)	67. (3)	107. (4)	147. (2)	187. (2)
28. (2)	68. (3)	108. (3)	148. (2)	188. (2)
29. (3)	69. (1)	109. (2)	149. (4)	189. (2)
30. (4)	70. (3)	110. (4)	150. (3)	190. (1)
31. (2)	71. (1)	111. (3)	151. (3)	191. (3)
32. (1)	72. (2)	112. (2)	152. (3)	192. (3)
33. (1)	73. (4)	113. (4)	153. (4)	193. (4)
34. (3)	74. (2)	114. (2)	154. (2)	194. (4)
35. (3)	75. (4)	115. (1)	155. (4)	195. (2)
36. (4)	76. (2)	116. (3)	156. (1)	196. (3)
37. (2)	77. (3)	117. (4)	157. (3)	197. (1)
38. (4)	78. (4)	118. (2)	158. (1)	198. (3)
39. (4)	79. (4)	119. (3)	159. (2)	199. (3)
40. (2)	80. (2)	120. (2)	160. (4)	200. (2)

# HINTS & SOLUTIONS

## [PHYSICS]

### SECTION - A

1. Answer (4)

**Hint:** Use work energy theorem and concept of friction between two surfaces in contact.

**Sol.:** Work done by friction can be positive, negative or zero.

Also, work done by conservative forces is equal to decrease in potential energy and work done by all forces is equal to change in K.E.

2. Answer (4)

**Hint:** Work done by friction,  $W = -\mu mgS$

**Sol.:** We know,  $a = \frac{2g - \mu g}{2 + 1}$

$$a = \frac{20 - (0.5)10}{3} = 5 \text{ m/s}^2$$

Here,  $v^2 - u^2 = 2aS$

$$S = \frac{v^2 - u^2}{2a} = \frac{10^2 - 0^2}{2(5)} = 10 \text{ m}$$

$$\therefore W = -\mu mgS = -0.5(1)(10)(10) = -50 \text{ J}$$

3. Answer (2)

**Hint:** Use Work-Energy theorem

**Sol.:** We know,  $W = \Delta KE$

$$W = \frac{1}{2}m(v^2 - u^2)$$

$$W = \frac{1}{2}(2)[6^2 - 2^2]$$

$$W = 36 - 4 = 32 \text{ J}$$

4. Answer (2)

**Hint:** Acceleration of system  $a = \frac{F}{m_1 + m_2 + m_3}$

**Sol.:** Here,  $a = \frac{40}{20} = 2 \text{ m/s}^2$

From FBD of 10 kg block

$$F - T = 10(a)$$

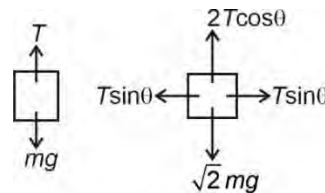


$$40 - T = 20$$

$$\therefore T = 20 \text{ N}$$

5. Answer (3)

**Hint:** Use FBD of block of mass 'm' and  $\sqrt{2}m$



**Sol.:** For equilibrium  $T = mg$

$$\text{and } 2T \cos \theta = \sqrt{2}mg$$

$$\therefore 2mg \cos \theta = \sqrt{2}mg$$

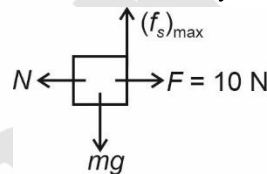
$$\Rightarrow \cos \theta = \frac{1}{\sqrt{2}}$$

Thus,  $\theta = 45^\circ$

6. Answer (1)

**Hint:** Here normal reaction is equal to applied force

**Sol.:** We know, by FBD of the block in equilibrium



$$\begin{aligned} mg &= (f_s)_{\max} \\ &= \mu N = \mu F = (0.2)10 \\ \therefore mg &= 2 \text{ N} \end{aligned}$$

7. Answer (2)

**Hint & Sol.:** Work done by conservative force is independent of path followed.

Here initial (A) and final (B) points are same in all three paths

$$\therefore W_1 = W_2 = W_3$$

8. Answer (1)

**Hint & Sol.:** Maximum value of static friction is known as limiting friction.

$$(f_s)_{\max} = f_l = \mu_s N$$

9. Answer (1)

**Hint:** Use  $K.E = W = FS \cos \theta$

**Sol.:** We know,  $K.E = FS \cos \theta$

$$\therefore \frac{d}{dt}(K.E) = \frac{d}{dt}FS \cos \theta$$

For constant force,

$$\frac{d}{dt}(K.E) = F \cos \theta \left( \frac{dS}{dt} \right)$$

$$= Fv \cos \theta = Fat \cos \theta \quad [v = at]$$

Thus,  $\frac{dKE}{dt} \propto t$

(as  $F$  and  $a$  are constant)

When a body remains at rest, it must be in equilibrium.

10. Answer (1)

**Hint:** For velocity after collision

$$v_1 = \left(\frac{m_1 - m_2}{m_1 + m_2}\right)u_1 + \left(\frac{2m_2}{m_1 + m_2}\right)u_2$$

**Sol.:** Here,  $m \ll M$ ,

$\therefore m$  can be neglected

$$v_1 = -\left(\frac{M}{M}\right)(6) + \left(\frac{2M}{M}\right)(4) = -6 + 8$$

$$v_1 = 2 \text{ m/s}$$

Thus, the lighter particle will move with a speed of 2 m/s in the original direction.

11. Answer (3)

**Hint & Sol.:** K.E. of a body can never be negative. It is independent of direction of motion.

In elastic collision the momentum and kinetic energy of system before and after collision is conserved.

12. Answer (1)

**Hint & Sol.:** We know, under the action of only conservative force (Gravitational force) loss in KE is equal to gain in PE and vice versa.

$$U = mgh, mgh + E = \text{constant}$$

$$\Rightarrow E = \text{constant} - mgh$$

13. Answer (1)

**Hint:** Momentum is conserved in all collisions.

**Sol.:** In perfectly inelastic collision although maximum KE is transferred but particle does not lose all their KE always.

14. Answer (1)

**Hint:**  $KE = \frac{p^2}{2m}$

**Sol.:** For equal momenta,

$$KE \propto \frac{1}{m}$$

$\therefore$  Lighter body will have more K.E.

15. Answer (3)

**Hint & Sol.:** In elastic collision, both momentum and kinetic energy of system before and after collision are conserved.

16. Answer (1)

**Hint:** Use, power  $P = \vec{F} \cdot \vec{v}$

**Sol.:** Here,  $\theta = 0^\circ$

$$\therefore P = (9000)(2) \cos 0^\circ$$

$$P = 18000 \text{ W}$$

$$\text{or, } P = 18 \text{ kW}$$

17. Answer (4)

**Hint:**  $W_{\text{external}} = \Delta K + \Delta U$

**Sol.:**  $\Delta U = \frac{MgL}{18}$

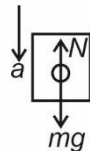
$$\Delta K = 0$$

$$W_{\text{external}} = \frac{MgL}{18}$$

18. Answer (2)

**Hint:** Apparent weight is less than actual weight when normal reaction is less than  $mg$

**Sol.:** For downward acceleration



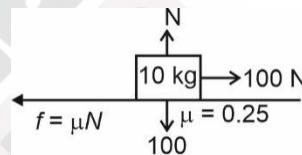
$$mg - N = ma$$

$$\therefore N = mg - ma$$

Thus,  $N < mg$

19. Answer (3)

**Hint:**



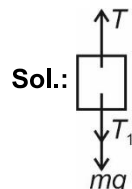
**Sol.:**

$$a = \frac{F - f}{m} = \frac{100 - (0.25)(100)}{10}$$

$$a = \frac{75}{10} = 7.5 \text{ m/s}^2$$

20. Answer (1)

**Hint:** System of blocks, will remain in equilibrium, hence tension force on 6 kg block is 6g.



Using FBD of 4 kg block

$$T = T_1 + mg$$

$$\therefore T_1 = T - mg$$

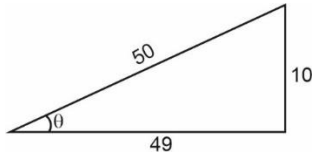
$$T_1 = 6g - 4g$$

$$T_1 = 2g = 20 \text{ N}$$

21. Answer (4)

Hint: Angle of repose is  $\tan\theta = \mu$

Sol.:

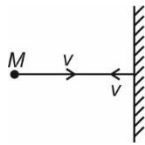


$$\mu = \frac{10}{49}$$

$$\mu \approx 0.2$$

22. Answer (4)

Hint & Sol.:



$$\Delta\vec{p} = \vec{p}_f - \vec{p}_i = -Mv - Mv = -2Mv$$

23. Answer (1)

Hint: Use stopping distance  $S = \frac{u^2}{2a}$

Sol.: Here it is clear that  $S \propto u^2$

24. Answer (4)

Hint: Use  $a = \frac{F}{m}$  and  $v = \sqrt{2as}$  [if  $u = 0$ ]

Sol.: Here,  $a = \frac{25 \times 10^5}{2 \times 10^7} = 12.5 \times 10^{-2} \text{ m/s}^2$

We know,  $v = \sqrt{2(12.5 \times 10^{-2}) \times 25}$

$$v = 25 \times 10^{-1} \text{ m/s}$$

$$v = 2.5 \text{ m/s}$$

25. Answer (2)

Hint: Use  $W = \vec{F} \cdot \vec{S}$

Where  $\vec{s} = \vec{r}_f - \vec{r}_i$

Sol.:  $\vec{F} = \frac{30}{\sqrt{3}}(\hat{i} + \hat{j} + \hat{k}) = 10\sqrt{3}(\hat{i} + \hat{j} + \hat{k})$

Hence,  $W = \vec{F} \cdot \Delta\vec{r} = \vec{F} \cdot (\vec{r}_2 - \vec{r}_1)$

$$= 10\sqrt{3}(\hat{i} + \hat{j} + \hat{k}) \cdot (2\hat{i} + \hat{k}) = 10\sqrt{3}(2 + 1) = 30\sqrt{3} \text{ J}$$

26. Answer (1)

Hint: Use  $\int dv = \int a dt$  and work-energy theorem

Sol.:  $dv = a dt = (2t\hat{i} + 3t^2\hat{j}) dt$

$$\int_0^v dv = \int_0^2 (2t\hat{i} + 3t^2\hat{j}) dt$$

Or velocity after 2 s is

$$\vec{v} = (4\hat{i} + 8\hat{j}) \text{ m/s}$$

Speed after 2 s

$$v = \sqrt{(4)^2 + (8)^2} = \sqrt{80} \text{ m/s}$$

From work-energy theorem

$$W = \frac{1}{2}mv^2 = \frac{1}{2} \times 80 = 40 \text{ J}$$

27. Answer (1)

Hint & Sol.: Use  $W = NS \cos 90^\circ$

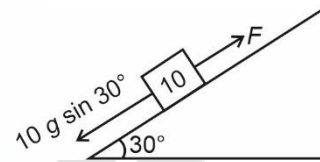
$$\cos 90^\circ = 0$$

$$\therefore W = 0$$

28. Answer (2)

Hint:  $W = \vec{F} \cdot \vec{d}$

Sol.:



$$F = mg \sin 30^\circ = \frac{1}{2} \times 10 \times 10 = 50 \text{ N}$$

Work done,  $W = \vec{F} \cdot \vec{d} = F \cdot d \cos 0^\circ = 50 \times 2 = 100 \text{ J}$

29. Answer (3)

Hint & Sol.:  $P = \frac{W}{t} = \frac{[ML^2T^{-2}]}{[T]}$

$$\therefore [P] = [ML^2T^{-3}]$$

30. Answer (4)

Hint: Area of F-S curve gives work done

Sol.: Area between curve and displacement axis

$$= \frac{1}{2} \times (12 + 4) \times 10 = 80 \text{ J}$$

In this time, body acquires kinetic energy  $= \frac{1}{2}mv^2$

By work energy theorem  $= \frac{1}{2}mv^2 = 80 \text{ J}$

$$= \frac{1}{2} \times 0.1 \times v^2 = 80 \Rightarrow v^2 = 1600 \Rightarrow v = 40 \text{ m/s}$$

31. Answer (2)

Hint: Total mechanical energy will remain conserved.

Sol.: Since,  $U = 0$  for  $x \geq 0$ , and at  $x = \sqrt{\frac{2E}{k}}, U = 0$

$$\Rightarrow E = 0 + \frac{1}{2}mv^2$$

$$\therefore v = \sqrt{\frac{2E}{m}}$$

32. Answer (1)

**Hint:** At the maximum compression  $x_m$ , the speed of block will be zero

**Sol.:** We have,

$$\Rightarrow mgh = \frac{1}{2}kx_m^2$$

$$\therefore x_m = \sqrt{\frac{2mgh}{k}}$$

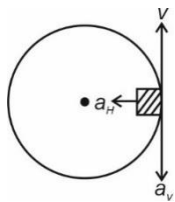
33. Answer (1)

**Hint:** When velocity becomes vertical then the body will have both vertical and horizontal accelerations

$$\therefore a_{\text{net}} = \sqrt{a_v^2 + a_H^2}$$

**Sol.:** Since the body is given just enough speed to complete the vertical circle,  $u = \sqrt{5gR}$

When the velocity  $v$  is vertical,  $v = \sqrt{3gR}$



$$a_H = \frac{v^2}{R} = \frac{3gR}{R} = 3g$$

$$a_v = g$$

$$\therefore a = \sqrt{(a_H)^2 + (a_v)^2} = \sqrt{(3g)^2 + g^2} = g\sqrt{10}$$

34. Answer (3)

**Hint & Sol.:**

$$1 \text{ joule} = 10^7 \text{ erg}$$

35. Answer (3)

**Hint:** When the projectile reach its topmost point then it has horizontal component of velocity only.

$$\text{Sol.} \quad KE = \frac{1}{2}m(u \cos 60)^2$$

$$= \frac{1}{2}m \times u^2 \times \left(\frac{1}{2}\right)^2 = \frac{1}{8}mu^2$$

### SECTION - B

36. Answer (4)

**Hint:** Conservation of mechanical energy.

$$\text{Sol.} \quad mgh = \frac{1}{2}mv^2$$

$$v = \sqrt{2gh}$$

$$v = 10 \text{ m/s}$$

37. Answer (2)

**Hint:** Use work-energy theorem and displacement

$$S = \frac{\text{Work done } (W)}{\text{Force } (F)}$$

$$\text{Sol.} \quad mg = 10 \text{ N}, \mu = 0.2, h = 2 \text{ m}, u = v = 0$$

Change in P.E = work done to increase K.E.

$$\rightarrow W = mgh = 10 \times 2 = 20 \text{ J}$$

Again on the horizontal surface the frictional force

$$F = \mu R = \mu mg = 0.2 \times 10 = 2 \text{ N}$$

So, the K.E is used to overcome friction

$$\rightarrow S = \frac{W}{F} = \frac{20 \text{ J}}{2 \text{ N}} = 10 \text{ m}$$

38. Answer (4)

**Hint & Sol.:** Coefficient of restitution is ratio of two speeds

$\therefore$  It is unitless

39. Answer (4)

**Hint & Sol.:** For jumping he presses the spring platform, so the reading of spring balance increases first and finally it becomes zero.

40. Answer (2)

**Hint & Sol.:** Action and reaction forces act on two different bodies.

41. Answer (3)

**Hint & Sol.:** 5 N force will not produce any tension in spring without support of other 5 N force. So here the tension in the spring will be 5 N only.

42. Answer (1)

**Hint & Sol.:** We know,

$$F_{\text{ext}} = \frac{d\vec{p}}{dt}$$

$\therefore$  Momentum of particle must change

But if  $F \perp dx$  then  $W = 0$

$\therefore$  K.E of particle may not change

43. Answer (4)

$$\text{Hint: } P = \vec{F} \cdot \vec{v}$$

$$\text{Sol.} \quad \vec{v} = (4\hat{i} + \hat{j} + 2\hat{k}) \text{ m/s}$$

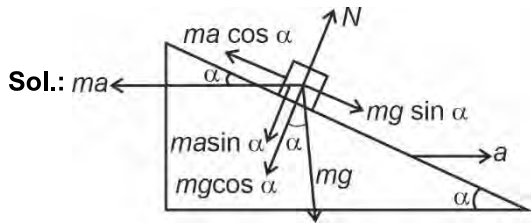
$$\vec{F} = (\hat{i} + 2\hat{j} + \hat{k}) \text{ N}$$

$$P = (4\hat{i} + \hat{j} + 2\hat{k}) \cdot (\hat{i} + 2\hat{j} + \hat{k})$$

$$= 4 + 2 + 2 = 8 \text{ W}$$

44. Answer (2)

**Hint:** Use concept of pseudo force for a non-inertial frame.



**Sol.:**  $ma \leftarrow$

Let the mass of a block is  $m$ . It will remain stationary with respect to wedge if forces acting on it are in equilibrium i.e.,  $ma \cos \alpha = mg \sin \alpha$

$\therefore a = g \tan \alpha$

45. Answer (3)

**Hint:** Use  $\vec{a} = \frac{d\vec{v}}{dt}$  and  $|\vec{F}| = m\sqrt{a_x^2 + a_y^2}$

**Sol.:** As  $\vec{v} = 5\hat{i} + 2\hat{j}$

$\therefore \vec{a} = \text{Zero}$

$\vec{F} = ma_x\hat{i} + m(g + a_y)\hat{j}$

$\therefore |\vec{F}| = mg$

$F = 20 \text{ N}$

46. Answer (3)

**Hint & Sol.:** We know,  $\vec{F}_{\text{ext}} = \frac{d\vec{p}}{dt}$

Thus, internal forces can't change momentum while they can change KE of the system.

47. Answer (3)

**Hint:** Use  $mg - T = ma$

$\therefore T = mg - ma$

**Sol.:** If monkey move downward with acceleration  $a$  then its apparent weight decreases. In that condition tension in string:

$T = m(g - a)$

This should not exceed over breaking strength of the rope  $360 \geq m(g - a)$

$\Rightarrow 360 \geq 40(10 - a)$

$\Rightarrow a \geq 1 \text{ m/s}^2$

48. Answer (2)

**Hint:**  $\vec{p}_1 + \vec{p}_2 = 0$

Thus,  $\vec{p}_1 = -\vec{p}_2$

$\therefore |\vec{p}_1| = |\vec{p}_2| = p$

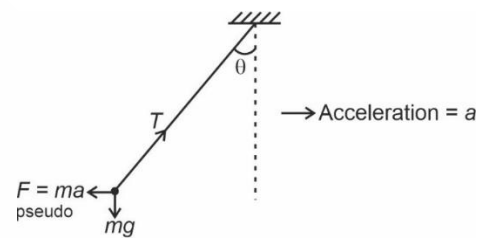
Use  $KE = \frac{p^2}{2m}$

**Sol.:** Total  $KE = \frac{p^2}{2m_1} + \frac{p^2}{2m_2}$

$KE = \frac{p^2(m_1 + m_2)}{2m_1m_2}$

49. Answer (3)

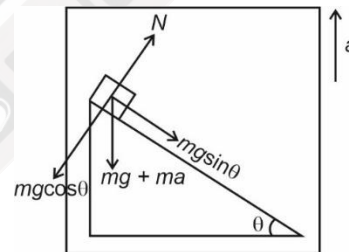
**Hint & Sol.:**



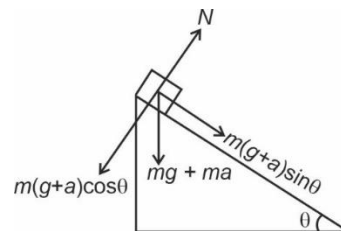
When railway car accelerates in right direction. Then Pseudo force act on bob in left direction with respect to car. So, the bob moves leftward.

50. Answer (1)

**Hint:** Use the given FBD



**Sol.:** Using concept of non-inertial frame the FBD of block will be



$\therefore a_n = \frac{F}{m} (\text{along incline}) \Rightarrow \frac{m(g+a)\sin\theta}{m} = a_n$

$\therefore a_n = (g+a)\sin\theta$

## [CHEMISTRY]

## SECTION - A

51. Answer (4)

**Hint:** Boron in  $\text{BF}_3$  is  $sp^2$  hybridised.**Sol.:** Bond angle in  $\text{H}_2\text{O}$  is  $104.5^\circ$ Bond angle in  $\text{NH}_3$  is  $107^\circ$ Bond angle in  $\text{CH}_4$  is  $109^\circ 28'$ Bond angle in  $\text{BF}_3$  is  $120^\circ$ 

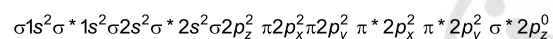
52. Answer (3)

**Hint:** Hybridisation of P in  $\text{PCl}_5$  is  $sp^3d$ **Sol.:** There are six  $90^\circ$  bonds in the structure of  $\text{PCl}_5$ .

53. Answer (1)

**Hint:** On moving down the group hydration energy of ion decreases.**Sol.:** Order of hydration enthalpy  $\text{F}^- > \text{Cl}^- > \text{Br}^- > \text{I}^-$ 

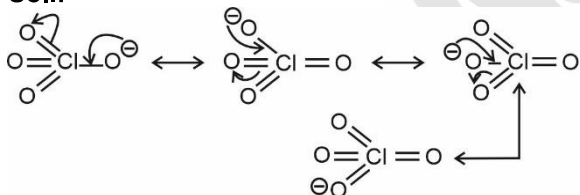
54. Answer (2)

**Sol.:** Configuration of  $\text{F}_2$ :Hence LUMO for  $\text{F}_2$   $\sigma^* 2p_z$ 

55. Answer (1)

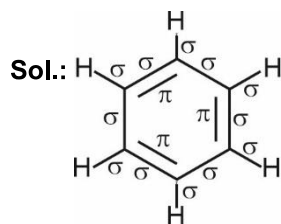
**Hint & Sol:** Heat and work are path functions whose value depends on initial and final state of system as well as path followed by the system.

56. Answer (4)

**Hint:** Resonance takes place in conjugated system.**Sol.:**

4 resonating structures

57. Answer (2)

**Hint:** Benzene is cyclic compound with three  $\pi$  bonds12 ' $\sigma$ ' and 3 ' $\pi$ ' bonds are present hence ratio as 4 : 1

58. Answer (2)

**Hint:** Hydrogen bond is formed if H is covalently bonded with high electronegative atom like N, O or F.**Sol.:** Since 'F' is most electronegative element it will result into strongest hydrogen bonding.

59. Answer (4)

**Hint:** Down the group atomic radius increases**Sol.:** With increase in effective nuclear charge, the atomic radius decreases. $\text{S} > \text{Cl} > \text{O} > \text{F}$ 

60. Answer (1)

**Hint:** Xe is  $sp^3d$  hybridised in  $\text{XeO}_2\text{F}_2$ **Sol.:**  $\text{XeO}_2\text{F}_2$  is see-saw in shape $\text{SF}_4 \Rightarrow$  see-saw $\text{SO}_4^{2-} \Rightarrow$  tetrahedral $\text{CCl}_4 \Rightarrow$  tetrahedral $\text{XeF}_4 \Rightarrow$  square planar

61. Answer (4)

**Hint:** Electronegativity increases on moving left to right along a period.**Sol.:** Fluorine is most electronegative element of periodic table.

62. Answer (3)

**Hint & Sol:** Germanium is Eka silicon.

63. Answer (4)

**Hint:** Halogen has negative electron gain enthalpy.**Sol.:** F has less negative electron gain enthalpy than Cl due to its smaller size and high charge density.

64. Answer (2)

**Hint:** Ionisation energy of cation is more than atom for a particular element.**Sol.:** In case of isoelectronic species, ionisation energy increases with increase in atomic number.

65. Answer (1)

<b>Hint &amp; Sol:</b>	1	0	7
	un	nil	sept

Hence IUPAC name is Unnilseptium

66. Answer (4)

**Hint:** Main group elements are called representative elements.**Sol.:** All s & p block elements are representative elements.

67. Answer (3)

**Hint:** Amphoteric oxide can react with both acid and bases.

**Sol.:**  $\text{Na}_2\text{O} \Rightarrow$  Basic

$\text{Cl}_2\text{O}_7 \Rightarrow$  Acidic

$\text{N}_2\text{O} \Rightarrow$  Neutral

$\text{Al}_2\text{O}_3 \Rightarrow$  Amphoteric

68. Answer (3)

**Hint:** Dipole moment depend on structure and bond moments of the molecule

**Sol.:** Compound                  Dipole moment (D)

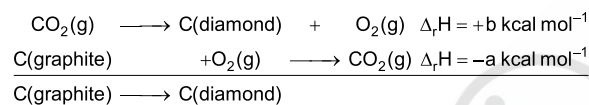
$\text{NH}_3$                                   1.47

$\text{NF}_3$                                   0.23

$\text{BF}_3$                                   0

69. Answer (1)

**Hint: & Sol.:** Reversing equation II and adding in equation I



$$\Delta_f H = b + (-a) = (b - a) \text{ kcal mol}^{-1}$$

70. Answer (3)

**Hint:** Standard enthalpy of formation of a substance is defined as the enthalpy change in the formation of one mole of compound from its elements in their most stable state of aggregation.

**Sol.:** Reference state of bromine is  $\text{Br}_2(\text{l})$

So, standard enthalpy of formation of  $\text{Br}_2(\text{l})$  is zero while that of  $\text{Br}_2(\text{g})$  is  $+30.91 \text{ kJ mol}^{-1}$ .

71. Answer (1)

**Hint:**  $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$

**Sol.:** As per the given equation, 1 mol of methane is burnt to produce 2 mol of water and one mole  $\text{CO}_2$ .

Enthalpy of combustion is the amount of heat produced on complete combustion of 1 mol of hydrocarbon.

So, combustion of 1 g of  $\text{CH}_4$  gives =  $55.65 \text{ kJ heat}$

$\therefore$  Combustion of 1 mol (16 g) of  $\text{CH}_4$  will give =  $55.65 \times 16$

$\approx 890 \text{ kJ}$

So,  $\Delta_f H = -890 \text{ kJ mol}^{-1}$

72. Answer (2)

**Hint:** Enthalpy of neutralisation of weak monobasic acid or weak monoacidic base is less than  $57.1 \text{ kJ mol}^{-1}$

**Sol.:** Enthalpy of ionisation of weak acid

= (Enthalpy of neutralisation) +  $57.1$

=  $-x + 57.1$

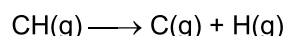
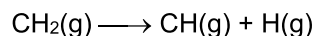
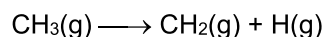
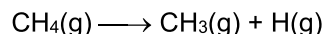
$\Rightarrow (57.1 - x)$

73. Answer (4)

**Hint:** Mean bond enthalpy of  $\text{CH}_4 = \frac{1}{4}(\Delta_a H_{\text{C-H}}^\ominus)$

**Sol.:**  $\Delta_{\text{C-H}} H^\ominus = \frac{1}{4} \times 1665 = 416.25 \text{ kJ mol}^{-1}$

In methane molecule, all four C – H bonds are identical in bond length but the breaking of successive bonds is as follow



All the steps above will have different energy.

74. Answer (2)

**Hint:** Process of conversion of gaseous molecule into atom(s) is the process of atomisation while conversion of an atom into anion is gaining of electron.

**Sol.:** (A)  $\text{Cl}_2(\text{g}) \longrightarrow 2\text{Cl}(\text{g}) \Rightarrow$  atomisation  $\Rightarrow \Delta_a H^\ominus$

(B)  $\text{Na}^+(\text{g}) + \text{Cl}^-(\text{g}) \longrightarrow \text{NaCl}(\text{s}) \Rightarrow$  Formation of crystal  $\Rightarrow \Delta_{\text{Lattice}} H^\ominus$

(C)  $\text{Ca}(\text{s}) + \text{C}(\text{graphite}) + \frac{3}{2}\text{O}_2 \longrightarrow \text{CaCO}_3(\text{s})$

$\Rightarrow$  formation of  $\text{CaCO}_3 \Rightarrow \Delta_f H^\ominus$

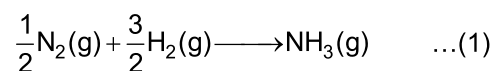
(D)  $\text{Cl}(\text{g}) \longrightarrow \text{Cl}^-(\text{g}) \Rightarrow$  electron gain by  $\text{Cl}(\text{g})$

$\Rightarrow \Delta_{\text{eg}} H^\ominus$

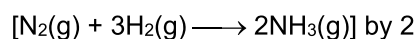
75. Answer (4)

**Hint:** Enthalpy change accompanied by the formation of one mol of a compound from its elements in their most stable state of aggregation is known  $\Delta_f H^\ominus$

**Sol.:** Formation of  $\text{NH}_3$  :



To get eqn (1) divide the given equation



$$\Rightarrow \frac{1}{2}[\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \longrightarrow 2\text{NH}_3(\text{g})] \frac{\Delta_f H^\ominus}{2} = \frac{-x}{2}$$

$$\therefore \frac{1}{2}\text{N}_2(\text{g}) + \frac{3}{2}\text{H}_2(\text{g}) \longrightarrow \text{NH}_3(\text{g}) \quad \Delta_f H^\ominus = \frac{-x}{2} \text{ kcal / mol}$$

76. Answer (2)

**Hint: & Sol.:** Sublimation process is direct conversion of a solid directly into gaseous state without undergoing liquid state at constant temperature and standard pressure enthalpy change in this process is enthalpy of sublimation denoted by  $\Delta_{\text{sub}} H^\ominus$

77. Answer (3)

**Hint:** Work done during expansion of a gas against a constant pressure is given as

$$W = -P_{\text{ext}}(V_f - V_i)$$

$$\begin{aligned} \text{Sol.: } W &= -1(1 - 0.5) \text{ L bar} \\ &= -0.5 \text{ L bar} = -0.5 \times 100 \text{ J} = -50 \text{ J} \end{aligned}$$

78. Answer (4)

**Hint:** In a cyclic process initial and final states coincide.

**Sol.:** In a cyclic process change in T, P, V, U, H are zero as initial and final states coincide with each other.

79. Answer (4)

**Hint:** Those physical properties which depend on the amount of matter present in a system are called extensive properties.

**Sol.:** Intensive properties – temperature, pressure, density

Extensive property – volume

80. Answer (2)

**Hint:** For spontaneous process,

$$\Delta G = -ve$$

$$\text{Sol.: } \Delta G = \Delta H - T\Delta S$$

When  $\Delta H$  and  $\Delta S$  both are greater than zero, reaction is spontaneous at high temperature.

81. Answer (4)

**Hint:** At equilibrium,  $\Delta G = 0$

$$\text{Sol.: } \Delta G = \Delta H - T\Delta S$$

$$0 = \Delta H - T\Delta S$$

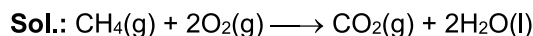
$$T = \frac{\Delta H}{\Delta S} = \frac{90 \times 1000}{300} = 300 \text{ K} = 27^\circ\text{C}$$

82. Answer (1)

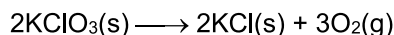
**Hint:** Entropy decreases when moles of gaseous product are less than moles of gaseous reactant.

$$\Delta n_g = -ve \Rightarrow \Delta S = -ve$$

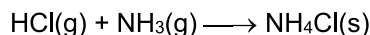
$$\Delta n_g = +ve \Rightarrow \Delta S = +ve$$



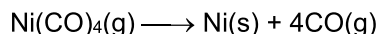
$$\Delta n_g = 1 - 3 = -2$$



$$\Delta n_g = 3$$



$$\Delta n_g = 0 - 2 = -2$$



$$\Delta n_g = 4 - 1 = 3$$

83. Answer (2)

$$\text{Hint: } \Delta S = \frac{q_{\text{rev}}}{T}$$

**Sol.:** For vaporisation

$$\Delta S = \frac{\Delta_{\text{vap}}H^\circ}{T} = \frac{0.5 \times 40.66 \times 10^3}{373} = 54.5 \text{ JK}^{-1}$$

84. Answer (2)

$$\text{Hint: } \Delta S = nR \ln \left( \frac{V_2}{V_1} \right)$$

**Sol.:**  $n = 1$

$$V_1 = 5 \text{ L}; V_2 = 50 \text{ L}$$

$$\begin{aligned} \therefore \Delta S &= nR \ln \left( \frac{V_2}{V_1} \right) \\ &= 2.303nR \log \left( \frac{V_2}{V_1} \right) \\ &= 2.303 \times 1 \times R \times \log \left( \frac{50}{5} \right) \\ &= 2.303R \end{aligned}$$

85. Answer (3)

**Hint:**  $\Delta H = \Delta U + \Delta nRT$

**Sol.:**  $\Delta G = \Delta H - T\Delta S$

$$\begin{aligned} &= 2.1 + 2 \times 2 \times 10^{-3} \times 300 - 300 \times 20 \times 10^{-3} \\ &= -2.7 \text{ kcal} \end{aligned}$$

## SECTION - B

86. Answer (2)

**Hint:** Absolute zero temperature means 0 kelvin

**Sol.:** At absolute zero temperature molecular motion of perfectly crystalline substances ceases.

87. Answer (3)

**Hint:**  $\Delta G^\circ = -2.303 RT \log K$

$$\text{Sol.: } K = 2 \times 10^3$$

$$T = 25^\circ\text{C} = 298 \text{ K}$$

$$\begin{aligned} \Delta G^\circ &= -2.303 \times R \times 298 \times \log (2 \times 10^3) \\ &= -2.303 R \times 298 \times 3.3 \\ &= -7.6 \times 298 \times R \end{aligned}$$

88. Answer (2)

**Hint:**  $\Delta H - \Delta U = \Delta n_g RT$

$$\text{Sol.: } \Delta n_g = 2 - \left( 1 + \frac{5}{2} \right)$$

$$= 2 - \frac{7}{2} = \frac{-3}{2}$$

$$\therefore \Delta H - \Delta U = \Delta n_g RT = -\frac{3}{2} RT$$

89. Answer (4)

**Hint:** Elements with atomic number more than that of uranium are transuranium elements.

**Sol.:** Lawrencium (Lr) is transuranium element.

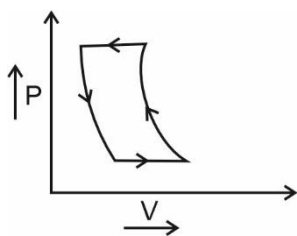
90. Answer (1)

**Hint:** For isothermal process temperature is constant during the process.

**Sol.:**

- For a cyclic process initial and final states are same.
- During isothermal expansion pressure drops while during isothermal compression pressure will rise.
- During isobaric expansion volume will increase by keeping pressure constant.

Hence correct PV graph will be



91. Answer (4)

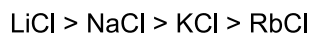
**Hint :** Hg has its atomic number,  $Z = 80$ .

**Sol.:** Hg belongs to 12<sup>th</sup> group and 6<sup>th</sup> period

92. Answer (4)

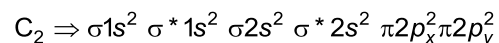
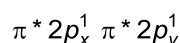
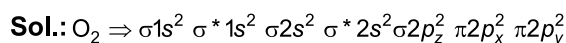
**Hint:** Ionic compounds with smaller cation and high charge density tend to have more covalent character.

**Sol.:** Order of covalent nature.



93. Answer (4)

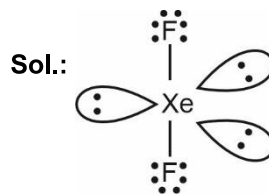
**Hint:** Electrons responsible for bonding in  $\text{C}_2$  are present in  $\pi$ -bonding molecular orbitals.



Hence  $\text{O}_2$  will have 1  $\sigma$  and 1  $\pi$  bond while  $\text{C}_2$  will have both  $\pi$  bonds.

94. Answer (3)

**Hint:** Xe is  $sp^3d$  hybridised with 3 lone pair of electron on central Xe atom in  $\text{XeF}_2$



Total number of lone pair of electrons = 9

95. Answer (1)

**Hint:** Hybridisation of carbon in  $\text{CO}_2$  is  $sp$

**Sol.:** Hybridisation of xenon in  $\text{XeF}_4$  is  $sp^3d^2$

Hybridisation of iodine in  $\text{IF}_7$  is  $sp^3d^3$

Hybridisation of iodine in  $\text{I}_3^+$  is  $sp^3$

96. Answer (2)

**Hint:** According to first law of thermodynamics ;

$$\Delta U = q + w$$

$$\text{Sol.}: \Delta U = q + w$$

$$\Delta U = +70 + (-150)$$

$$= -80 \text{ J}$$

97. Answer (3)

**Hint:** Atomic Number of mendelevium is 101.

**Sol.:** IUPAC official name      Atomic number

Nobelium                              102

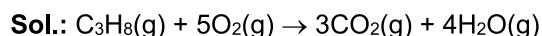
Mendelevium                          101

Dubnium                                105

Bohrium                                107

98. Answer (3)

**Hint:**  $q_p = q_v + \Delta n_g RT$



$$\Delta H = \Delta U + \Delta n_g RT$$

$$\Delta n_g = 1$$

$$\Delta H = -30 \times 10^3 + 1 \times 8.314 \times 400 = -26.67 \text{ kJ}$$

99. Answer (4)

**Hint:**  $\Delta G = \Delta H - T\Delta S$

$$\text{Sol.}: \Delta G = -20 \times 10^3 - 300 \times 30$$

$$= -29 \times 10^3 \text{ J} = -29 \text{ kJ}$$

100. Answer (2)

**Hint: & Sol.:** Thermodynamically most stable state of oxygen is  $\text{O}_2(\text{g})$ .

**[BOTANY]****SECTION-A**

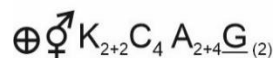
101. Answer (3)

**Hint:** In mango and coconut, the fruit is known as drupe and they develop from monocarpellary superior ovaries.

**Sol.:** In mango, the pericarp is well differentiated into an outer thin epicarp, a middle fleshy edible mesocarp. In coconut mesocarp is fibrous.

102. Answer (2)

**Hint:** The floral formula for mustard is



**Sol.:** Mustard flower possess superior ovary in which gynoecium occupies the highest position while other parts are situated below it.

103. Answer (4)

**Hint:** Members of Fabaceae family show diadelphous androecium.

**Sol.:** China rose shows monoadelphous condition.

104. Answer (3)

**Hint:** Pneumatophore roots come out of the ground and grow vertically upward in plants growing in swampy areas.

**Sol.:** Pneumatophores help to get oxygen for respiration and they show negative geotropism.

105. Answer (2)

**Hint:** Keel is the two smallest anterior petals of the flower showing vexillary aestivation.

**Sol.:** In flower of *Indigofera*, corolla consist of a posterior standard, two lateral wings, two anterior ones forming a keel which encloses stamens and pistils.

106. Answer (1)

**Hint:** The cells proximal to the region of meristematic activity form region of elongation.

**Sol.:** Cells in the region of elongation are responsible for the growth of root in length.

107. Answer (4)

**Hint:** In gourds, stems are modified into tendrils and help plants to climb.

**Sol.:** In pea, leaves are converted into tendrils for climbing.

108. Answer (3)

**Hint:** In cymose type of inflorescence the flowers are borne in a basipetal order.

**Sol.:** *Solanum* shows cymose inflorescence.

109. Answer (2)

**Hint:** Fibrous root system is observed in wheat plant.

**Sol.:** In wheat plant, the primary root is short lived and replaced by a large number of roots and these roots originate from base of the stem.

110. Answer (4)

**Hint:** If more than two leaves arise at a node and form a whorl, then it is called whorled phyllotaxy.

**Sol.:** *Alstonia* shows whorled phyllotaxy.

111. Answer (3)

**Hint:** In brinjal, hypogynous flowers are present.

**Sol.:** In brinjal, gynoecium occupies the highest position while other parts are situated below it. The ovary is said to be superior. e.g, mustard, China rose, brinjal.

112. Answer (2)

**Hint:** Brassicaceae –  $\oplus \underset{\text{♀}}{\overset{\text{♂}}{\text{K}}}_{2+2} \text{C}_4 \text{A}_{2+4} \underline{\text{G}}_{(2)}$

Fabaceae –  $\% \underset{\text{♀}}{\overset{\text{♂}}{\text{K}}}_{(5)} \text{C}_{1+2+(2)} \text{A}_{(9)+1} \underline{\text{G}}_1$

Solanaceae –  $\oplus \underset{\text{♀}}{\overset{\text{♂}}{\text{K}}}_{(5)} \text{C}_{(5)} \text{A}_5 \underline{\text{G}}_{(2)}$

Liliaceae –  $\text{Br} \oplus \underset{\text{♀}}{\overset{\text{♂}}{\text{P}}}_{(3+3)} \text{A}_{3+3} \underline{\text{G}}_{(3)}$

**Sol.:** Mustard – Brassicaceae

Groundnut – Fabaceae

Onion – Liliaceae

Tobacco – Solanaceae

113. Answer (4)

**Hint:** In zygomorphic symmetry, flowers can be divided into two similar halves only in one vertical plane.

**Sol.:** Flowers of pea, gulmohur and sunhemp show zygomorphic symmetry.

114. Answer (2)

**Hint:** Papilionaceous corolla, is found in the members of Fabaceae.

**Sol.:** Tulip is the member of Liliaceae family in which perianth is present.

115. Answer (1)

**Hint:** When shoot apical meristem changes to floral meristem, internode do not elongate and the axis get condensed.

**Sol.:** The apex produces different kinds of floral appendages laterally at successive nodes instead of leaves.

116. Answer (3)

**Hint:** In *Dianthus* and Primrose, ovules are borne on the central axis and septa are absent.

**Sol.:** In *Dianthus* and Primrose, the placentation is called free central.

117. Answer (4)  
**Hint:** Protoxylem and metaxylem are two types of primary xylem.  
**Sol.:** In roots, the protoxylem lies towards periphery and metaxylem lies towards centre. Such arrangement of primary xylem is called exarch.
118. Answer (2)  
**Hint:** Sieve tube and companion cells are component of phloem they are absent in gymnosperm.  
**Sol.:** Vessels are found in angiosperms. Vessels are characteristic feature of angiosperm.
119. Answer (3)  
**Hint:** All the tissues except epidermis and vascular bundle constitute the ground tissue.  
**Sol.:** Subsidiary cells are epidermal cells.
120. Answer (2)  
**Hint:** Large and colourless cells are present in adaxial epidermal cells of grass leaves (monocot).  
**Sol.:** Bulliform cells in monocot become flaccid due to water stress and make the grass leaves curl inwards to minimise water loss.
121. Answer (2)  
**Hint:** In dicot stem, pericycle is present on the inner side of the endodermis and above the phloem in the form of semilunar patches of sclerenchyma.  
**Sol.:** In dicot stem, cortical layers below hypodermis consist of rounded thin walled parenchymatous cells with conspicuous intercellular spaces.
122. Answer (4)  
**Hint:** Cork cambium is an example of lateral meristem.  
**Sol.:** Sclerenchymatous cells are present in the walls of fruit. Collenchyma provides support to the growing parts of the plant. Cork cambium is responsible for producing secondary tissues. Parenchyma is simple permanent tissue and it forms the major component within the organ.
123. Answer (3)  
**Hint:** Next to endodermis lies a few layers of thick walled parenchymatous cells referred to as pericycle.  
**Sol.:** Initiation of lateral roots and vascular cambium during the secondary growth of dicot roots takes place with the help of pericycle.
124. Answer (2)  
**Hint:** In spring season, cambium is very active.  
**Sol.:** In spring wood, large number of xylary elements having vessels with wider cavity is present. It is lighter in colour and has lower density.
125. Answer (3)  
**Hint:** Plant tissues devoid of protoplast are dead.  
**Sol.:** Phelloderm or secondary cortex develops during the secondary growth. It has thin walled parenchymatous cells. These are living cells and possess cellulosic cell wall.
126. Answer (2)  
**Hint:** In floral formula, corolla is represented by C.  
**Sol.:** In floral formula, calyx is represented by K.
127. Answer (4)  
**Hint:** It is an aquatic plant.  
**Sol.:** In aquatic plant like *Pistia* and *Eichhornia*, a lateral branch with short internodes and each node bearing rosette of leaves and tuft of roots, is present.
128. Answer (1)  
**Hint:** Tomato belongs to Solanaceae family.  
**Sol.:** In tomato, gynoecium shows syncarpous condition as the carpels are fused.
129. Answer (2)  
**Hint:** Tulip is a member of Liliaceae family.  
**Sol.:** Tulip shows valvate aestivation of perianth.
130. Answer (3)  
**Hint:** Primary meristem contributes to formation of primary plant body.  
**Sol.:** Both apical and intercalary meristems are primary meristems because they appear early in life of a plant and contribute to the formation of the primary plant body.
131. Answer (2)  
**Hint:** Phellogen, phellem and phelloderm are collectively known as periderm.  
**Sol.:** Cork cambium (Phellogen), cork (phellem) and secondary cortex (Phelloderm) are collectively known as periderm.
132. Answer (4)  
**Hint:** All the tissues outside the vascular cambium constitute the bark.  
**Sol.:** Bark consists of periderm, primary cortex, pericycle, primary and secondary phloem.
133. Answer (2)  
**Hint:** Companion cells are parenchymatous cells and closely associated with sieve tube elements.  
**Sol.:** Xylem parenchyma stores substances like tannins. Vessels are made up of many cells and they are interconnected through perforations in their walls. Phloem parenchyma is absent in most of monocot plants.

134. Answer (3)

**Hint:** In dicot leaf abaxial epidermis generally bears more stomata than the adaxial epidermis.

**Sol.:** In dicot leaf, the vascular bundles are surrounded by layer of thick walled bundle sheath cells.

135. Answer (1)

**Sol.:** In dicot stem, the cells of cambium present between primary xylem and primary phloem is intrafascicular cambium.

### SECTION-B

136. Answer (2)

**Hint:** Prop roots are hanging roots coming out from branches of banyan tree for support.

**Sol.:** The stems of maize and sugarcane have supporting roots coming out of lower nodes of the stem called stilt roots.

137. Answer (3)

**Hint:** Aggregate fruits develop from polycarpellary, apocarpous ovary.

**Sol.:** Simple fruits develop from the syncarpous ovary of the single flower with or without accessory parts.

138. Answer (2)

**Hint:** Roots in carrot or turnip get modified to store food.

**Sol.:** Roots do not possess nodes and internodes.

139. Answer (4)

**Hint:** Lily family is a representative of monocotyledonous plants.

**Sol.:** *Asparagus* is a member of Liliaceae family and it is a monocot plant.

140. Answer (1)

**Hint:** Castor is a dicot plant.

**Sol.:** In castor seed, two cotyledons are present. Monocot seeds have one large and shield shaped cotyledon known as scutellum.

141. Answer (3)

**Hint:** Androecium with  $A_{3+3}$  condition is observed in members of Liliaceae.

**Sol.:** *Gloriosa* is an ornamental plant belonging to Liliaceae family.

142. Answer (2)

**Hint:** In some plant primary tap root or adventitious root get modified to store food.

**Sol.:** Adventitious roots of sweet potato get swollen and store food.

In turnip, carrot and beet, the primary tap root is modified to store food.

143. Answer (4)

**Hint:** All of the given characteristics are observed in members of Solanaceae family.

**Sol.:** Chilli is a member of Solanaceae family.

It exhibits all the mentioned features.

144. Answer (3)

**Hint:** Cells of cambium cut off towards pith mature into secondary xylem and the cells cut off towards periphery mature into secondary phloem.

**Sol.:** The correct sequence of the tissues in the stem showing secondary growth from pith towards cortex is as follows.

Primary xylem → Secondary xylem → Secondary phloem → Primary phloem.

145. Answer (4)

**Hint:** Innermost layer of cortex is not a part of stele.

**Sol.:** All tissues on the inner side of the endodermis such as pericycle, vascular bundle and pith constitute the stele.

146. Answer (2)

**Hint:** The conjoint vascular bundles are commonly found in stems and leaves.

**Sol.:** In conjoint type of vascular bundles, xylem and phloem are jointly situated along the same radius of the vascular bundle.

147. Answer (2)

**Hint:** Stems of a particular plant group have water containing cavities.

**Sol.:** Water containing cavities are present within the vascular bundles of monocot stem.

148. Answer (2)

**Hint:** In dicot leaf, mesophyll is differentiated into two types of cells.

**Sol.:** In monocot leaf, like maize leaf, mesophyll is not differentiated into palisade and spongy parenchyma.

149. Answer (4)

**Hint:** The trichome in the shoot system are usually multicellular.

**Sol.:** Root hair and trichomes are epidermal appendages.

150. Answer (3)

**Hint:** This layer is not a part of stele.

**Sol.:** The cells of the endodermis in dicot stem are rich in the starch grain and is also referred to as the starch sheath.

**[ZOOLOGY]****SECTION - A**

151. Answer (3)

**Hint:** Increase in heart beat leads to change in cardiac output

**Sol.:** Parasympathetic neural signals decrease the rate of heart beat, speed of conduction of action potentials, thereby the cardiac output. Adrenal medullary hormones can also increase the cardiac output. The electrical activity of the heart can be recorded from the body surface by using electrocardiograph and the graphical representation of the electrical activity of the heart during a cardiac cycle is called electrocardiogram (ECG) which is of great clinical importance.

152. Answer (3)

**Hint:** QRS complex represents the depolarisation of ventricles.

**Sol.:** Atrial diastole starts when ventricles undergo contraction. The QRS complex represents the depolarisation of the ventricles, which initiates the ventricular contraction. The T-wave represents the return of the ventricles from excited to normal state (repolarisation). The end of T-wave marks the end of the systole.

153. Answer (4)

**Hint:** It carries the deoxygenated blood.

**Sol.:** The deoxygenated blood pumped by the right ventricle enters into the pulmonary artery, whereas the left ventricle pumps oxygenated blood into the aorta. The deoxygenated blood pumped into pulmonary artery is passed on to the lungs. Superior vena cava and inferior vena cava carry deoxygenated blood from the body and pour it in the right auricle of the heart.

154. Answer (2)

**Hint:** Intake of O<sub>2</sub> and removal of CO<sub>2</sub>

**Sol.:** The systemic circulation provides nutrients, O<sub>2</sub> and other essential substances to the tissues and takes CO<sub>2</sub> and other harmful substances away for elimination.

155. Answer (4)

**Hint:** Equal to the number of layers present in diffusion membrane at alveolar site

**Sol.:** The glomerular capillary blood pressure causes filtration of blood through 3 layers, i.e. the endothelium of glomerular blood vessels, the epithelium of Bowman's capsule and a basement membrane between these two layers.

156. Answer (1)

**Hint:** Deficiency of RBCs in foetal blood

**Sol.:** Rh incompatibility could be fatal to the foetus or could cause severe anaemia and jaundice to the baby. This condition is called erythroblastosis foetalis. This can be avoided by administering anti - Rh antibodies to the Rh -ve mother immediately after the delivery of the first Rh +ve child.

157. Answer (3)

**Hint:** Annelids and chordates have a closed circulatory system.

**Sol.:** All vertebrates possess a muscular, chambered heart. Amphibians and the reptiles (except crocodiles) have a 3-chambered heart with two atria and single ventricle, whereas crocodiles and birds possess a 4-chambered heart. Human heart has the size of a clenched fist. Erythroblastosis foetalis can be avoided by administering anti-Rh antibodies to the Rh -ve mother immediately after the delivery of the first Rh +ve child.

158. Answer (1)

**Hint:** ADH increases the blood pressure and GFR.

**Sol.:** Juxtaglomerular apparatus is a special sensitive region formed by cellular modifications in the DCT and afferent arteriole at the location of their contact. A fall in GFR can activate the JG cells to release renin which can stimulate the glomerular blood flow and thereby the GFR back to normal. Aldosterone causes reabsorption of Na<sup>+</sup> and water from the distal parts of tubule.

159. Answer (2)

**Hint:** Number of bones in each upper limb in humans

**Sol.:** On an average, 25-30 gm of urea is excreted out per day by an adult man under normal physiological conditions.

160. Answer (4)

**Hint:** Universal recipients

**Sol.:** Person with 'AB' blood group can accept blood from person with AB as well as the other groups of blood. Therefore, such persons are called 'universal recipients'.

161. Answer (2)

**Hint:** Clear liquid part of blood

**Sol.:** Plasma without the clotting factors is called serum. Fibrinogens are needed for clotting or coagulation of blood. Globulins are primarily involved in defense mechanisms of the body and the albumins help in osmotic balance.

162. Answer (1)

**Hint:** Plasma contains minerals and lipids.

**Sol.:** Plasma contains small amounts of minerals like  $\text{Na}^+$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{HCO}_3^-$ ,  $\text{Cl}^-$  etc. Glucose, amino acids, lipids, etc, are also present in the plasma as they are always in transit in the body.

163. Answer (3)

**Hint:** It secretes heparin and serotonin.

**Sol.:** Neutrophils are the most abundant cells (60-65 per cent) of the total WBCs and basophils are the least (0.5-1 per cent) among them. Neutrophils and monocytes (6-8 per cent) are phagocytic cells which destroy foreign organisms entering the body. Basophils secrete histamine, serotonin, heparin, etc. and are also involved in inflammatory reactions. Eosinophils (2-3 per cent) resist infections and are also associated with allergic reactions.

164. Answer (2)

**Hint:** Dialysing fluid contains all of the components of plasma except urea.

**Sol.:** In haemodialysis, the blood drained from a convenient artery is pumped into a dialysing unit. The unit contains a coiled cellophane tube surrounded by a fluid having the same composition as that of plasma except the nitrogenous wastes. The porous cellophane membrane of tubes allows the passage of molecules based on concentration gradient. As nitrogenous wastes are absent in the dialysing fluid, these substances freely move out, thereby clearing the blood.

165. Answer (1)

**Hint:** Uremia leads to renal failure.

**Sol.:** Malfunctioning of kidneys can lead to accumulation of urea in blood, a condition called uremia, which is highly harmful and may lead to kidney failure.

Renal calculi - Stone or insoluble mass of crystallised salts (oxalates) formed within the kidney.

Glomerulonephritis – Inflammation of glomeruli of kidney.

166. Answer (4)

**Hint:** Medulla oblongata can moderate the cardiac functions through ANS.

**Sol.:** The body has the ability to alter the stroke volume as well as the heart rate and thereby the cardiac output, for example the cardiac output of an athlete will be much higher than that of an ordinary man.

167. Answer (4)

**Hint:** Atrio-ventricular valves of both sides of the heart.

**Sol.:** The first heart sound (lub) is associated with the closure of the tricuspid and bicuspid valves whereas the second heart sound (dub) is associated with the closure of the semilunar valves. These heart sounds are of clinical diagnostic significance.

168. Answer (3)

**Hint:** Identify a granulocyte.

**Sol.:** Neutrophils and monocytes are phagocytic cells which destroy foreign organisms entering the body. Basophils secrete histamine, serotonin, heparin etc., and are involved in inflammatory reactions. Eosinophils resist infections and are also associated with allergic reactions. Lymphocytes are of two major types 'B' and 'T'. Both 'B' and 'T' lymphocytes are responsible for immune responses of the body.

169. Answer (2)

**Hint:** Concave surface of the kidney

**Sol.:** Towards the centre of the inner concave surface of the kidney is a notch called hilum through which ureter, blood vessels and nerves enter. Inner to the hilum is a broad funnel shaped space called the renal pelvis with projections called calyces. The inner part of kidney has two parts i.e., cortex and medulla. The medulla is divided into a few medullary pyramids.

170. Answer (1)

**Hint:** Sometimes called congestive heart failure

**Sol.:** **Heart failure** means the state of heart when it is not pumping blood effectively enough to meet the needs of the body

**Cardiac arrest** – When the heart stops beating

**Heart attack** – When the heart muscles is suddenly damaged by an inadequate blood supply.

**Angina pectoris** – Acute chest pain appears when no enough oxygen is reaching the heart muscles.

171. Answer (1)

**Hint:** Heart is the pumping organ.

**Sol.:** Heart failure means the state of heart when it is not pumping blood effectively enough to meet the needs of the body. It is sometimes called congestive heart failure because congestion of lungs is one of the main symptoms of this disease. High blood pressure leads to heart diseases and also affects vital organs like brain and kidney.

172. Answer (2)

**Hint:** Activation of RAAS

**Sol.:** The JGA plays a complex regulatory role. A fall in glomerular blood flow/GFR can activate the JG cells to release renin which converts angiotensinogen in blood to angiotensin I and further to angiotensin II. Angiotensin II, being a powerful vasoconstrictor, increases the glomerular blood pressure and thus, GFR. An increase in blood flow to the atria of heart can cause the release of ANF.

173. Answer (1)

**Hint:** Stroke volume

**Sol.:** During a cardiac cycle, each ventricle pumps out approximately 70 mL of blood which is called the stroke volume. The stroke volume multiplied by the heart rate (number of beats per minute) gives the cardiac output. Therefore, the cardiac output can be defined as the volume of blood pumped out by each ventricle per minute and averages 5000 mL or 5 litres in a healthy individual.

174. Answer (2)

**Hint:** Average beats are 72 times  $\text{min}^{-1}$ .

**Sol.:** The SAN can generate the maximum number of action potentials, *i.e.*, 70-75  $\text{min}^{-1}$  and is responsible for initiating and maintaining the rhythmic contractile activity of the heart. Therefore, it is called the pacemaker. Our heart normally beats 70-75 times in a minute.

175. Answer (3)

**Hint:** Stroke volume multiplied by heart rate gives the cardiac output.

**Sol.:** The stroke volume multiplied by heart rate can be defined as the volume of blood pumped out by each ventricle per minute (Cardiac output).

Cardiac output (CO) = Stroke volume (SV) × Number of heart beats per minute

Stroke volume = 75 mL

Heart rate = 100 beats/min

∴ CO = 100 × 75 mL/min

Cardiac output is 7500 mL/min.

176. Answer (4)

**Hint:** Occurs at the beginning of ventricular diastole

**Sol.:** During ventricular systole, ventricular pressure increases further due to which the semilunar valves guarding the pulmonary artery and the aorta are forced open, allowing the blood in the ventricles to flow through these vessels into the circulating pathways. The ventricles now relax (ventricular diastole) and the ventricular pressure falls causing the closure of the semilunar valves which prevents the backflow of blood into the ventricles.

177. Answer (3)

**Hint:** Four chambered heart

**Sol.:** Fishes have a 2-chambered heart with an atrium and a ventricle. Reptiles (except crocodiles) have 3-chambered heart with two atria and a single ventricle whereas crocodiles, birds and mammals possess a 4-chambered heart with two atria and two ventricles. Two separate circulatory pathways are present in birds, crocodiles and mammals, hence these animals exhibit double circulation.

178. Answer (3)

**Hint:** Metamerically segmented animals

**Sol.:** Protonephridia or flame cells are the excretory structures in platyhelminths (flatworms, *e.g.* *Planaria*), rotifers, some annelids and the cephalochordates such as *Amphioxus*.

179. Answer (3)

**Hint:** 12<sup>th</sup> thoracic vertebra

**Sol.:** In humans, kidneys are situated between the levels of last thoracic and third lumbar vertebra close to the dorsal inner wall of the abdominal cavity.

180. Answer (4)

**Hint:** Equals to number of metacarpals in both hands of man

**Sol.:** Each kidney of an adult human measures 10-12 cm in length, 5-7 cm in width, 2-3 cm in thickness with an average weight of 120-170 gm.

181. Answer (1)

**Hint:** Can generate maximum number of action potentials

**Sol.:** The SAN can generate the maximum number of action potentials, *i.e.* 70-75  $\text{min}^{-1}$ , and is responsible for initiating and maintaining the rhythmic contractile activity of heart. A bundle of nodal fibres, AV bundle continues from AVN which passes through the atrio-ventricular septa to emerge on the top of the interventricular septum and immediately divides into a right and left bundle. These branches give rise to minute fibres throughout the ventricular musculature of the respective sides and are called Purkinje fibers. The nodal musculature has the ability to generate action potentials without any external stimuli, *i.e.*, it is autoexcitable.

182. Answer (2)

**Hint:** Possesses podocytes

**Sol.:** The renal tubule begins with a double walled cup-like structure called Bowman's capsule, which encloses the glomerulus. Glomerulus along with Bowman's capsule is called Malpighian body or renal corpuscle. The tubule continues further to form a highly coiled network-proximal convoluted tubule. The cortex extends in between the medullary pyramids as renal columns called columns of Bertini.

183. Answer (1)

**Hint:** Function of CD

**Sol.:** PCT is lined by simple cuboidal brush border epithelium. Nearly all of the essential nutrients and 70-80 percent of electrolytes and water are reabsorbed by this segment. PCT also helps to maintain the pH and ionic balance of the body fluids by selective secretion of hydrogen ions, and ammonia into the filtrate and by absorption of  $\text{HCO}_3^-$  from it.

Collecting duct allows passage of small amounts of urea into the medullary interstitium to keep up the osmolarity.

184. Answer (4)

**Hint:** Ascending and descending limbs help in it

**Sol.:** Henle's loop - Reabsorption is minimum in its ascending limb however, this region plays a significant role in the maintenance of high osmolarity of medullary interstitial fluid. 70-80 per cent of electrolytes and water are reabsorbed in PCT. Conditional reabsorption of  $\text{Na}^+$  and water takes place in the DCT. Collecting duct also plays an important role in maintenance of pH and ionic balance of body by selective secretion of  $\text{H}^+$  and  $\text{K}^+$  ions.

185. Answer (1)

**Hint:** Antennal gland

**Sol.:** Malpighian tubules are the excretory structures of most of the insects including cockroaches. Antennal glands or green glands perform the excretory function in crustaceans like prawns. Nephridia are the tubular excretory structures of earthworms and other annelids. Vertebrates have complex tubular organs called kidneys. Malpighian body is the part of nephron which is present in the kidneys.

### SECTION - B

186. Answer (3)

**Hint:** 140/90 shows hypertension.

**Sol.:** Hypertension is the term used for blood pressure that is higher than normal (120/80 mmHg) after repeated checks. In this measurement 120 mm Hg is the systolic, or pumping pressure and 80 mm Hg is the diastolic or resting pressure.

187. Answer (2)

**Hint:** Collecting duct also helps in the maintenance of pH and ionic balance of body.

**Sol.:** Descending limb of loop of Henle is permeable to water but almost impermeable to electrolytes. The ascending limb is impermeable to water but allows transport of electrolytes actively or passively. Collecting duct allows passage of small amounts of urea into the medullary interstitium to keep up the osmolarity.

188. Answer (2)

**Hint:** Rh +ve father

**Sol.:** A special case of Rh incompatibility has been observed between the Rh -ve blood of a pregnant mother with Rh +ve blood of the foetus.

189. Answer (2)

**Hint:** Above systolic blood pressure

**Sol.:** On an average, 1100-1200 mL of blood is filtered by the kidneys per minute. GFR in a healthy individual is approximately 125 mL/minute *i.e.*, 180 litres per day. A comparison of volume of the filtrate formed per day (180 litres per day) with that of urine released (1.5 litre), suggest that nearly 99 per cent of the filtrate has to be reabsorbed by the renal tubules.

190. Answer (1)

**Hint:** Glucose and amino acids are reabsorbed actively.

**Sol.:** The tubular epithelial cells in different segments of nephron perform reabsorption either by active or passive mechanisms. For example, substances like glucose, amino acids,  $\text{Na}^+$ , *etc.*, in the filtrate are reabsorbed actively whereas the nitrogenous wastes are absorbed by passive transport. Reabsorption of water also occurs passively in the initial segments of the nephron.

191. Answer (3)

**Hint:** Composition of plasma

**Sol.:** Lymph has the same mineral distribution as that in plasma. Exchange of nutrients, gases, *etc.*, between blood and the cells always occurs through this fluid. Lymph is a colourless fluid containing specialised lymphocytes which are responsible for immune responses of the body. Lymph is also an important carrier for nutrients, hormones, *etc.* Fats are absorbed through lymph in the lacteals present in the intestinal villi.

192. Answer (3)

**Hint:** Tricuspid valves are partially open

**Sol.:** Tricuspid valves are partially open because of the damaged chordae tendinae attached to right atrium. In such case, blood will tend to flow back into right atrium which leads to decrease the blood flow in the pulmonary artery.

193. Answer (4)

**Hint:** Its level in blood is regulated by parathyroid hormone.

**Sol.:** Calcium ions play a very important role in clotting of blood.

194. Answer (4)

**Hint:** Uremia leads to renal failure.

**Sol.:** Presence of ketone bodies in urine is called ketonuria. Malfunctioning of kidney can lead to accumulation of urea in blood, a condition called uremia, which is highly harmful and may lead to kidney failure.

195. Answer (2)

**Hint:** Excreted *via* sebum

**Sol.:** Sweat produced by the sweat glands is a watery fluid containing  $\text{NaCl}$ , small amounts of urea, lactic acid, *etc.* Sterols are present in sebum.

196. Answer (3)

**Hint:** Produced by atria of the heart

**Sol.:** An increase in blood flow to the atria of the heart can cause the release of ANF. ANF can cause vasodilation and thereby decreases the blood pressure. ANF mechanism acts as a check on the renin-angiotensin mechanism.

197. Answer (1)

**Hint:** ADH increases blood pressure

**Sol.:** ADH can also affect the kidney function by its constrictory effect on blood vessels. This causes an increase in blood pressure. An increase in blood pressure can increase the glomerular blood flow and thereby the GFR.

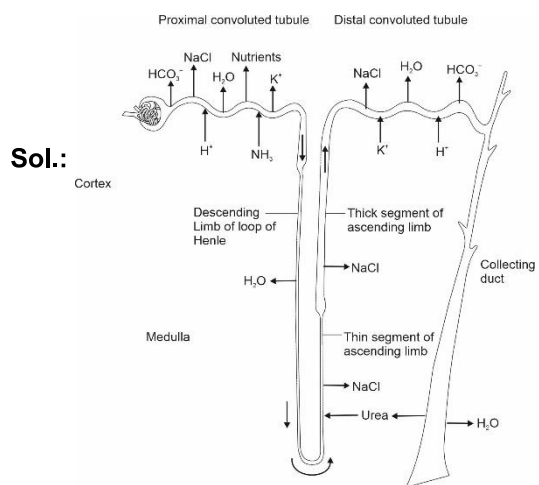
198. Answer (3)

**Hint:** Equals to the total number of bones in pectoral girdle

**Sol.:** Human kidneys can produce urine nearly four times concentrated than the initial filtrate formed.

199. Answer (3)

**Hint:** Not the part of nephron



200. Answer (2)

**Hint:** Identify the function of cell fragments present in the blood

**Sol.:** Dark reddish brown scum formed at the site of a cut or an injury over a period of time. It is a clot or coagulum formed mainly of a network of thread called fibrins in which dead and damaged formed elements of blood are trapped. Precipitation occurs during interaction between antibodies and antigens.



## All India Aakash Test Series for NEET-2025

**TEST - 3 (Code-J)**

Test Date : 07/01/2024

**ANSWERS**

1. (4)	41. (3)	81. (2)	121. (1)	161. (3)
2. (4)	42. (2)	82. (4)	122. (2)	162. (2)
3. (2)	43. (4)	83. (4)	123. (4)	163. (1)
4. (2)	44. (1)	84. (3)	124. (2)	164. (2)
5. (3)	45. (3)	85. (2)	125. (3)	165. (1)
6. (1)	46. (2)	86. (2)	126. (1)	166. (1)
7. (2)	47. (4)	87. (4)	127. (3)	167. (2)
8. (1)	48. (4)	88. (3)	128. (2)	168. (3)
9. (1)	49. (2)	89. (3)	129. (4)	169. (4)
10. (1)	50. (4)	90. (2)	130. (2)	170. (4)
11. (2)	51. (4)	91. (1)	131. (3)	171. (1)
12. (4)	52. (3)	92. (3)	132. (2)	172. (2)
13. (1)	53. (1)	93. (4)	133. (1)	173. (3)
14. (4)	54. (2)	94. (4)	134. (4)	174. (1)
15. (4)	55. (1)	95. (4)	135. (2)	175. (2)
16. (1)	56. (4)	96. (1)	136. (3)	176. (1)
17. (3)	57. (2)	97. (4)	137. (4)	177. (4)
18. (2)	58. (2)	98. (2)	138. (2)	178. (1)
19. (4)	59. (4)	99. (3)	139. (2)	179. (2)
20. (1)	60. (1)	100. (2)	140. (2)	180. (1)
21. (3)	61. (4)	101. (3)	141. (4)	181. (4)
22. (1)	62. (2)	102. (2)	142. (3)	182. (3)
23. (1)	63. (4)	103. (4)	143. (4)	183. (3)
24. (1)	64. (2)	104. (3)	144. (2)	184. (3)
25. (3)	65. (1)	105. (2)	145. (3)	185. (4)
26. (3)	66. (3)	106. (1)	146. (1)	186. (2)
27. (3)	67. (1)	107. (4)	147. (4)	187. (3)
28. (1)	68. (3)	108. (3)	148. (2)	188. (3)
29. (1)	69. (3)	109. (2)	149. (3)	189. (1)
30. (2)	70. (4)	110. (4)	150. (2)	190. (3)
31. (4)	71. (1)	111. (3)	151. (3)	191. (2)
32. (3)	72. (2)	112. (2)	152. (3)	192. (4)
33. (2)	73. (4)	113. (3)	153. (4)	193. (4)
34. (1)	74. (3)	114. (4)	154. (2)	194. (3)
35. (1)	75. (4)	115. (2)	155. (4)	195. (3)
36. (1)	76. (3)	116. (2)	156. (1)	196. (1)
37. (3)	77. (2)	117. (3)	157. (3)	197. (2)
38. (2)	78. (2)	118. (2)	158. (1)	198. (2)
39. (3)	79. (1)	119. (4)	159. (2)	199. (2)
40. (3)	80. (4)	120. (3)	160. (4)	200. (3)

# HINTS & SOLUTIONS

## [PHYSICS]

### SECTION - A

1. Answer (4)

**Hint:** Use work energy theorem and concept of friction between two surfaces in contact.

**Sol.:** Work done by friction can be positive, negative or zero.

Also, work done by conservative forces is equal to decrease in potential energy and work done by all forces is equal to change in K.E.

2. Answer (4)

**Hint:** Work done by friction,  $W = -\mu mgS$

**Sol.:** We know,  $a = \frac{2g - \mu g}{2 + 1}$

$$a = \frac{20 - (0.5)10}{3} = 5 \text{ m/s}^2$$

Here,  $v^2 - u^2 = 2aS$

$$S = \frac{v^2 - u^2}{2a} = \frac{10^2 - 0^2}{2(5)} = 10 \text{ m}$$

$$\therefore W = -\mu mgS = -0.5(1)(10)(10) = -50 \text{ J}$$

3. Answer (2)

**Hint:** Use Work-Energy theorem

**Sol.:** We know,  $W = \Delta KE$

$$W = \frac{1}{2}m(v^2 - u^2)$$

$$W = \frac{1}{2}(2)[6^2 - 2^2]$$

$$W = 36 - 4 = 32 \text{ J}$$

4. Answer (2)

**Hint:** Acceleration of system  $a = \frac{F}{m_1 + m_2 + m_3}$

**Sol.:** Here,  $a = \frac{40}{20} = 2 \text{ m/s}^2$

From FBD of 10 kg block

$$F - T = 10(a)$$

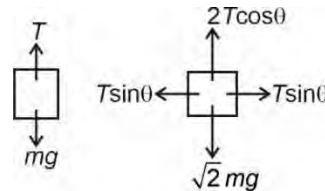


$$40 - T = 20$$

$$\therefore T = 20 \text{ N}$$

5. Answer (3)

**Hint:** Use FBD of block of mass 'm' and  $\sqrt{2}m$



**Sol.:** For equilibrium  $T = mg$

$$\text{and } 2T \cos \theta = \sqrt{2}mg$$

$$\therefore 2mg \cos \theta = \sqrt{2}mg$$

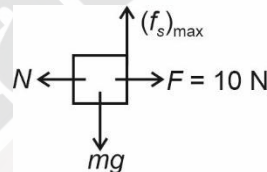
$$\Rightarrow \cos \theta = \frac{1}{\sqrt{2}}$$

Thus,  $\theta = 45^\circ$

6. Answer (1)

**Hint:** Here normal reaction is equal to applied force

**Sol.:** We know, by FBD of the block in equilibrium



$$\begin{aligned} mg &= (f_s)_{\max} \\ &= \mu N = \mu F = (0.2)10 \\ \therefore mg &= 2 \text{ N} \end{aligned}$$

7. Answer (2)

**Hint & Sol.:** Work done by conservative force is independent of path followed.

Here initial (A) and final (B) points are same in all three paths

$$\therefore W_1 = W_2 = W_3$$

8. Answer (1)

**Hint & Sol.:** Maximum value of static friction is known as limiting friction.

$$(f_s)_{\max} = f_l = \mu_s N$$

9. Answer (1)

**Hint:** Use  $K.E = W = FS \cos \theta$

**Sol.:** We know,  $K.E = FS \cos \theta$

$$\therefore \frac{d}{dt}(K.E) = \frac{d}{dt}FS \cos \theta$$

For constant force,

$$\frac{d}{dt}(K.E) = F \cos \theta \left( \frac{dS}{dt} \right)$$

$$= Fv \cos \theta = Fat \cos \theta \quad [v = at]$$

$$\text{Thus, } \frac{dKE}{dt} \propto t$$

(as  $F$  and  $a$  are constant)

When a body remains at rest, it must be in equilibrium.

10. Answer (1)

**Hint:** For velocity after collision

$$v_1 = \left( \frac{m_1 - m_2}{m_1 + m_2} \right) u_1 + \left( \frac{2m_2}{m_1 + m_2} \right) u_2$$

**Sol.:** Here,  $m \ll M$ ,

$\therefore m$  can be neglected

$$v_1 = -\left( \frac{M}{M} \right) (6) + \left( \frac{2M}{M} \right) (4) = -6 + 8$$

$$v_1 = 2 \text{ m/s}$$

Thus, the lighter particle will move with a speed of 2 m/s in the original direction.

11. Answer (2)

**Hint:** Use  $W = \vec{F} \cdot \vec{S}$

$$\text{Where } \vec{s} = \vec{r}_f - \vec{r}_i$$

$$\text{Sol.} \quad \vec{F} = \frac{30}{\sqrt{3}} (\hat{i} + \hat{j} + \hat{k}) = 10\sqrt{3} (\hat{i} + \hat{j} + \hat{k})$$

$$\text{Hence, } W = \vec{F} \cdot \Delta \vec{r} = \vec{F} \cdot (\vec{r}_2 - \vec{r}_1)$$

$$= 10\sqrt{3} (\hat{i} + \hat{j} + \hat{k}) \cdot (2\hat{i} + \hat{k}) = 10\sqrt{3} (2 + 1) = 30\sqrt{3} \text{ J}$$

12. Answer (4)

**Hint:** Use  $a = \frac{F}{m}$  and  $v = \sqrt{2as}$  [if  $u = 0$ ]

$$\text{Sol.} \quad \text{Here, } a = \frac{25 \times 10^5}{2 \times 10^7} = 12.5 \times 10^{-2} \text{ m/s}^2$$

$$\text{We know, } v = \sqrt{2(12.5 \times 10^{-2}) \times 25}$$

$$v = 25 \times 10^{-1} \text{ m/s}$$

$$v = 2.5 \text{ m/s}$$

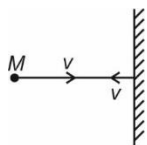
13. Answer (1)

**Hint:** Use stopping distance  $S = \frac{u^2}{2a}$

**Sol.:** Here it is clear that  $S \propto u^2$

14. Answer (4)

**Hint & Sol.:**

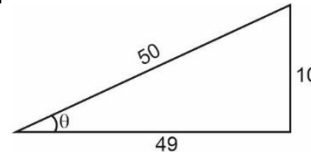


$$\Delta \vec{p} = \vec{p}_f - \vec{p}_i = -Mv - Mv = -2Mv$$

15. Answer (4)

**Hint:** Angle of repose is  $\tan \theta = \mu$

**Sol.:**

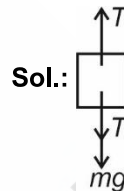


$$\mu = \frac{10}{49}$$

$$\mu \approx 0.2$$

16. Answer (1)

**Hint:** System of blocks, will remain in equilibrium, hence tension force on 6 kg block is 6g.



**Sol.:**

Using FBD of 4 kg block

$$T = T_1 + mg$$

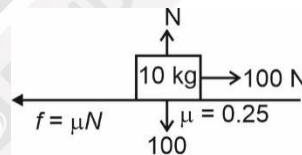
$$\therefore T_1 = T - mg$$

$$T_1 = 6g - 4g$$

$$T_1 = 2g = 20 \text{ N}$$

17. Answer (3)

**Hint:**



**Sol.:**

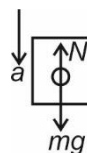
$$a = \frac{F - f}{m} = \frac{100 - (0.25)(100)}{10}$$

$$a = \frac{75}{10} = 7.5 \text{ m/s}^2$$

18. Answer (2)

**Hint:** Apparent weight is less than actual weight when normal reaction is less than  $mg$

**Sol.:** For downward acceleration



$$mg - N = ma$$

$$\therefore N = mg - ma$$

Thus,  $N < mg$

19. Answer (4)

**Hint:**  $W_{\text{external}} = \Delta K + \Delta U$ 

**Sol.:**  $\Delta U = \frac{MgL}{18}$

$$\Delta K = 0$$

$$W_{\text{external}} = \frac{MgL}{18}$$

20. Answer (1)

**Hint:** Use, power  $P = \vec{F} \cdot \vec{v}$ **Sol.:** Here,  $\theta = 0^\circ$ 

$$\therefore P = (9000)(2) \cos 0^\circ$$

$$P = 18000 \text{ W}$$

$$\text{or, } P = 18 \text{ kW}$$

21. Answer (3)

**Hint & Sol.:** In elastic collision, both momentum and kinetic energy of system before and after collision are conserved.

22. Answer (1)

**Hint:**  $KE = \frac{p^2}{2m}$

**Sol.:** For equal momenta,

$$KE \propto \frac{1}{m}$$

 $\therefore$  Lighter body will have more K.E.

23. Answer (1)

**Hint:** Momentum is conserved in all collisions.**Sol.:** In perfectly inelastic collision although maximum KE is transferred but particle does not lose all their KE always.

24. Answer (1)

**Hint & Sol.:** We know, under the action of only conservative force (Gravitational force) loss in KE is equal to gain in PE and vice versa.

$$U = mgh, mgh + E = \text{constant}$$

$$\Rightarrow E = \text{constant} - mgh$$

25. Answer (3)

**Hint & Sol.:** K.E. of a body can never be negative. It is independent of direction of motion.

In elastic collision the momentum and kinetic energy of system before and after collision is conserved.

26. Answer (3)

**Hint:** When the projectile reach its topmost point then it has horizontal component of velocity only.

**Sol.:**  $KE = \frac{1}{2}m(u \cos 60^\circ)^2$

$$= \frac{1}{2}m \times u^2 \times \left(\frac{1}{2}\right)^2 = \frac{1}{8}mu^2$$

27. Answer (3)

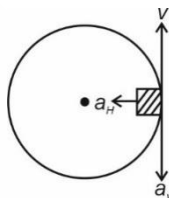
**Hint & Sol.:**

$$1 \text{ joule} = 10^7 \text{ erg}$$

28. Answer (1)

**Hint:** When velocity becomes vertical then the body will have both vertical and horizontal accelerations

$$\therefore a_{\text{net}} = \sqrt{a_V^2 + a_H^2}$$

**Sol.:** Since the body is given just enough speed to complete the vertical circle,  $u = \sqrt{5gR}$ When the velocity  $v$  is vertical,  $v = \sqrt{3gR}$ 

$$a_H = \frac{v^2}{R} = \frac{3gR}{R} = 3g$$

$$a_V = g$$

$$\therefore a = \sqrt{(a_H)^2 + (a_V)^2} = \sqrt{(3g)^2 + g^2} = g\sqrt{10}$$

29. Answer (1)

**Hint:** At the maximum compression  $x_m$ , the speed of block will be zero**Sol.:** We have,

$$\Rightarrow mgh = \frac{1}{2}kx_m^2$$

$$\therefore x_m = \sqrt{\frac{2mgh}{k}}$$

30. Answer (2)

**Hint:** Total mechanical energy will remain conserved.**Sol.:** Since,  $U = 0$  for  $x \geq 0$ , and at  $x = \sqrt{\frac{2E}{k}}$ ,  $U = 0$ 

$$\Rightarrow E = 0 + \frac{1}{2}mv^2$$

$$\therefore v = \sqrt{\frac{2E}{m}}$$

31. Answer (4)

**Hint:** Area of  $F$ - $S$  curve gives work done**Sol.:** Area between curve and displacement axis

$$= \frac{1}{2} \times (12 + 4) \times 10 = 80 \text{ J}$$

In this time, body acquires kinetic energy  $= \frac{1}{2}mv^2$

By work energy theorem  $= \frac{1}{2}mv^2 = 80\text{ J}$

$$= \frac{1}{2} \times 0.1 \times v^2 = 80 \Rightarrow v^2 = 1600 \Rightarrow v = 40\text{ m/s}$$

32. Answer (3)

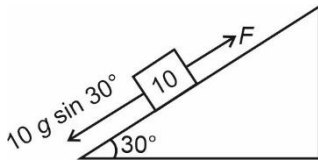
**Hint & Sol.:**  $P = \frac{W}{t} = \frac{[ML^2T^{-2}]}{[T]}$

$\therefore [P] = [ML^2T^{-3}]$

33. Answer (2)

**Hint:**  $W = \vec{F} \cdot \vec{d}$

**Sol. :**



$$F = mg \sin 30^\circ = \frac{1}{2} \times 10 \times 10 = 50\text{ N}$$

Work done,  $W = \vec{F} \cdot \vec{d} = F \cdot d \cos 0^\circ = 50 \times 2 = 100\text{ J}$

34. Answer (1)

**Hint & Sol.:** Use  $W = NS \cos 90^\circ$

$\cos 90^\circ = 0$

$\therefore W = 0$

35. Answer (1)

**Hint:** Use  $\int dv = \int a dt$  and work-energy theorem

**Sol.:**  $dv = a dt = (2t\hat{i} + 3t^2\hat{j}) dt$

$$\int_0^v dv = \int_0^2 (2t\hat{i} + 3t^2\hat{j}) dt$$

Or velocity after 2 s is

$$\vec{v} = (4\hat{i} + 8\hat{j})\text{ m/s}$$

Speed after 2 s

$$v = \sqrt{(4)^2 + (8)^2} = \sqrt{80}\text{ m/s}$$

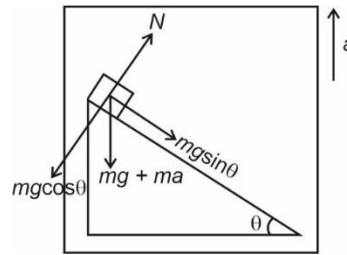
From work-energy theorem

$$W = \frac{1}{2}mv^2 = \frac{1}{2} \times 80 = 40\text{ J}$$

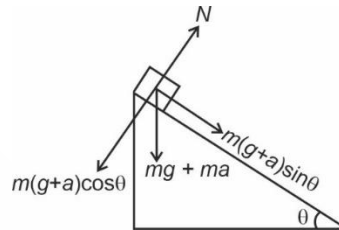
**SECTION - B**

36. Answer (1)

**Hint:** Use the given FBD



**Sol.:** Using concept of non-inertial frame the FBD of block will be

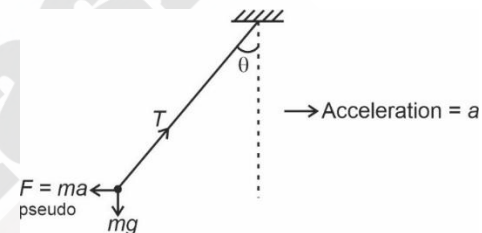


$$\therefore a_n = \frac{F}{m} (\text{along incline}) \Rightarrow \frac{m(g+a)\sin\theta}{m} = a_n$$

$$\therefore a_n = (g+a)\sin\theta$$

37. Answer (3)

**Hint & Sol.:**



When railway car accelerates in right direction. Then Pseudo force act on bob in left direction with respect to car. So, the bob moves leftward.

38. Answer (2)

**Hint:**  $\vec{p}_1 + \vec{p}_2 = 0$

Thus,  $\vec{p}_1 = -\vec{p}_2$

$\therefore |\vec{p}_1| = |\vec{p}_2| = p$

Use  $KE = \frac{p^2}{2m}$

**Sol.:** Total  $KE = \frac{p^2}{2m_1} + \frac{p^2}{2m_2}$

$$KE = \frac{p^2(m_1 + m_2)}{2m_1m_2}$$

39. Answer (3)

**Hint:** Use  $mg - T = ma$

$\therefore T = mg - ma$

**Sol.:** If monkey move downward with acceleration  $a$  then its apparent weight decreases. In that condition tension in string:

$$T = m(g - a)$$

This should not exceed over breaking strength of the rope  $360 \geq m(g - a)$

$$\Rightarrow 360 \geq 40(10 - a)$$

$$\Rightarrow a \geq 1 \text{ m/s}^2$$

40. Answer (3)

**Hint & Sol.:** We know,  $\vec{F}_{\text{ext}} = \frac{d\vec{p}}{dt}$

Thus, internal forces can't change momentum while they can change KE of the system.

41. Answer (3)

**Hint:** Use  $\vec{a} = \frac{d\vec{v}}{dt}$  and  $|\vec{F}| = m\sqrt{a_x^2 + a_y^2}$

**Sol.:** As  $\vec{v} = 5\hat{i} + 2\hat{j}$

$\therefore \vec{a} = \text{Zero}$

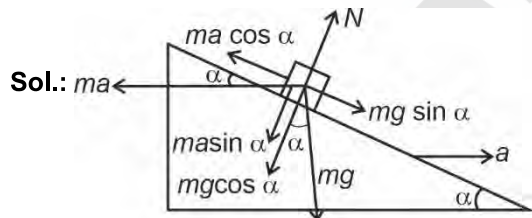
$$\vec{F} = ma_x\hat{i} + m(g + a_y)\hat{j}$$

$\therefore |\vec{F}| = mg$

$$F = 20 \text{ N}$$

42. Answer (2)

**Hint:** Use concept of pseudo force for a non-inertial frame.



Let the mass of a block is  $m$ . It will remain stationary with respect to wedge if forces acting on it are in equilibrium i.e.,  $ma \cos \alpha = mg \sin \alpha$

$$\therefore a = g \tan \alpha$$

43. Answer (4)

**Hint:**  $P = \vec{F} \cdot \vec{v}$

**Sol.:**  $\vec{v} = (4\hat{i} + \hat{j} + 2\hat{k}) \text{ m/s}$

$$\vec{F} = (\hat{i} + 2\hat{j} + \hat{k}) \text{ N}$$

$$P = (4\hat{i} + \hat{j} + 2\hat{k}) \cdot (\hat{i} + 2\hat{j} + \hat{k})$$

$$= 4 + 2 + 2 = 8 \text{ W}$$

44. Answer (1)

**Hint & Sol.:** We know,

$$F_{\text{ext}} = \frac{d\vec{p}}{dt}$$

$\therefore$  Momentum of particle must change

But if  $F \perp dx$  then  $W = 0$

$\therefore$  K.E of particle may not change

45. Answer (3)

**Hint & Sol.:** 5 N force will not produce any tension in spring without support of other 5 N force. So here the tension in the spring will be 5 N only.

46. Answer (2)

**Hint & Sol.:** Action and reaction forces act on two different bodies.

47. Answer (4)

**Hint & Sol.:** For jumping he presses the spring platform, so the reading of spring balance increases first and finally it becomes zero.

48. Answer (4)

**Hint & Sol.:** Coefficient of restitution is ratio of two speeds

$\therefore$  It is unitless

49. Answer (2)

**Hint:** Use work-energy theorem and displacement

$$S = \frac{\text{Work done } (W)}{\text{Force } (F)}$$

**Sol.:**  $mg = 10 \text{ N}$ ,  $\mu = 0.2$ ,  $h = 2 \text{ m}$ ,  $u = v = 0$

Change in P.E = work done to increase K.E.

$$\rightarrow W = mgh = 10 \times 2 = 20 \text{ J}$$

Again on the horizontal surface the frictional force

$$F = \mu R = \mu mg = 0.2 \times 10 = 2 \text{ N}$$

So, the K.E is used to overcome friction

$$\rightarrow S = \frac{W}{F} = \frac{20 \text{ J}}{2 \text{ N}} = 10 \text{ m}$$

50. Answer (4)

**Hint:** Conservation of mechanical energy.

$$\text{Sol.} \quad mgh = \frac{1}{2}mv^2$$

$$v = \sqrt{2gh}$$

$$v = 10 \text{ m/s}$$

## [CHEMISTRY]

## SECTION - A

51. Answer (4)

**Hint:** Boron in  $\text{BF}_3$  is  $sp^2$  hybridised.**Sol.:** Bond angle in  $\text{H}_2\text{O}$  is  $104.5^\circ$ Bond angle in  $\text{NH}_3$  is  $107^\circ$ Bond angle in  $\text{CH}_4$  is  $109^\circ 28'$ Bond angle in  $\text{BF}_3$  is  $120^\circ$ 

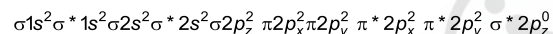
52. Answer (3)

**Hint:** Hybridisation of P in  $\text{PCl}_5$  in  $sp^3d$ **Sol.:** There are six  $90^\circ$  bonds in the structure of  $\text{PCl}_5$ .

53. Answer (1)

**Hint:** On moving down the group hydration energy of ion decreases.**Sol.:** Order of hydration enthalpy  $\text{F}^- > \text{Cl}^- > \text{Br}^- > \text{I}^-$ 

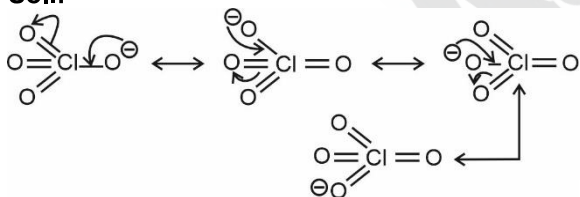
54. Answer (2)

**Sol.:** Configuration of  $\text{F}_2$ :Hence LUMO for  $\text{F}_2$   $\sigma^* 2p_z$ 

55. Answer (1)

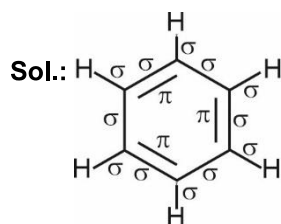
**Hint & Sol:** Heat and work are path functions whose value depends on initial and final state of system as well as path followed by the system.

56. Answer (4)

**Hint:** Resonance takes place in conjugated system.**Sol.:**

4 resonating structures

57. Answer (2)

**Hint:** Benzene is cyclic compound with three  $\pi$  bonds12 ' $\sigma$ ' and 3 ' $\pi$ ' bonds are present hence ratio as 4 : 1

58. Answer (2)

**Hint:** Hydrogen bond is formed if H is covalently bonded with high electronegative atom like N, O or F.**Sol.:** Since 'F' is most electronegative element it will result into strongest hydrogen bonding.

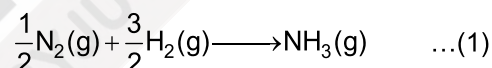
59. Answer (4)

**Hint:** Down the group atomic radius increases**Sol.:** With increase in effective nuclear charge, the atomic radius decreases. $\text{S} > \text{Cl} > \text{O} > \text{F}$ 

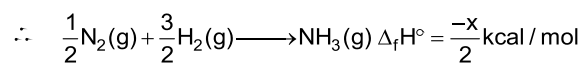
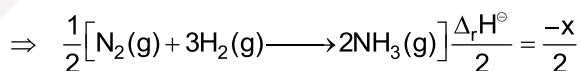
60. Answer (1)

**Hint:** Xe is  $sp^3d$  hybridised in  $\text{XeO}_2\text{F}_2$ **Sol.:**  $\text{XeO}_2\text{F}_2$  is see-saw in shape $\text{SF}_4 \Rightarrow$  see-saw $\text{SO}_4^{2-} \Rightarrow$  tetrahedral $\text{CCl}_4 \Rightarrow$  tetrahedral $\text{XeF}_4 \Rightarrow$  square planar

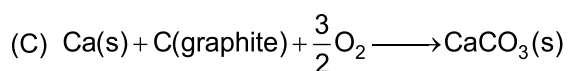
61. Answer (4)

**Hint:** Enthalpy change accompanied by the formation of one mol of a compound from its elements in their most stable state of aggregation is known  $\Delta_f H^\ominus$ **Sol.:** Formation of  $\text{NH}_3$  :

To get eqn (1) divide the given equation

 $[\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \longrightarrow 2\text{NH}_3(\text{g})]$  by 2

62. Answer (2)

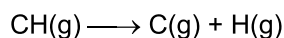
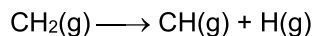
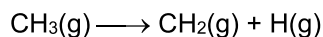
**Hint:** Process of conversion of gaseous molecule into atom(s) is the process of atomisation while conversion of an atom into anion is gaining of electron.**Sol.:** (A)  $\text{Cl}_2(\text{g}) \longrightarrow 2\text{Cl}(\text{g}) \Rightarrow$  atomisation  $\Rightarrow \Delta_a H^\ominus$ (B)  $\text{Na}^+(\text{g}) + \text{Cl}^-(\text{g}) \longrightarrow \text{NaCl}(\text{s}) \Rightarrow$  Formation of crystal  $\Rightarrow \Delta_{\text{Lattice}} H^\ominus$  $\Rightarrow$  formation of  $\text{CaCO}_3 \Rightarrow \Delta_f H^\ominus$ (D)  $\text{Cl}(\text{g}) \longrightarrow \text{Cl}^-(\text{g}) \Rightarrow$  electron gain by  $\text{Cl}(\text{g})$  $\Rightarrow \Delta_{\text{eg}} H^\ominus$

63. Answer (4)

**Hint:** Mean bond enthalpy of  $\text{CH}_4 = \frac{1}{4}(\Delta_a H_{\text{C-H}}^\ominus)$

**Sol.:**  $\Delta_{\text{C-H}} H^\ominus = \frac{1}{4} \times 1665 = 416.25 \text{ kJ mol}^{-1}$

In methane molecule, all four C – H bonds are identical in bond length but the breaking of successive bonds is as follow



All the steps above will have different energy.

64. Answer (2)

**Hint:** Enthalpy of neutralisation of weak monobasic acid or weak monoacidic base is less than  $57.1 \text{ kJ mol}^{-1}$

**Sol.:** Enthalpy of ionisation of weak acid  
 = (Enthalpy of neutralisation) + 57.1  
 =  $-x + 57.1$

$\Rightarrow (57.1 - x)$

65. Answer (1)

**Hint:**  $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$

**Sol.:** As per the given equation, 1 mol of methane is burnt to produce 2 mol of water and one mole  $\text{CO}_2$ .

Enthalpy of combustion is the amount of heat produced on complete combustion of 1 mol of hydrocarbon.

So, combustion of 1 g of  $\text{CH}_4$  gives = 55.65 kJ heat

$\therefore$  Combustion of 1 mol (16 g) of  $\text{CH}_4$  will give  
 =  $55.65 \times 16$

$\approx 890 \text{ kJ}$

So,  $\Delta_r H = -890 \text{ kJ mol}^{-1}$

66. Answer (3)

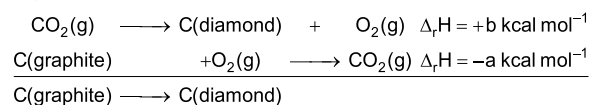
**Hint:** Standard enthalpy of formation of a substance is defined as the enthalpy change in the formation of one mole of compound from its elements in their most stable state of aggregation.

**Sol.:** Reference state of bromine is  $\text{Br}_2(\text{l})$

So, standard enthalpy of formation of  $\text{Br}_2(\text{l})$  is zero while that of  $\text{Br}_2(\text{g})$  is  $+30.91 \text{ kJ mol}^{-1}$ .

67. Answer (1)

**Hint: & Sol.:** Reversing equation II and adding in equation I



$\Delta_r H = b + (-a) = (b - a) \text{ kcal mol}^{-1}$

68. Answer (3)

**Hint:** Dipole moment depend on structure and bond moments of the molecule

<b>Sol.:</b> Compound	Dipole moment (D)
$\text{NH}_3$	1.47
$\text{NF}_3$	0.23
$\text{BF}_3$	0

69. Answer (3)

**Hint:** Amphoteric oxide can react with both acid and bases.

**Sol.:**  $\text{Na}_2\text{O} \Rightarrow$  Basic

$\text{Cl}_2\text{O}_7 \Rightarrow$  Acidic

$\text{N}_2\text{O} \Rightarrow$  Neutral

$\text{Al}_2\text{O}_3 \Rightarrow$  Amphoteric

70. Answer (4)

**Hint:** Main group elements are called representative elements.

**Sol.:** All s & p block elements are representative elements.

71. Answer (1)

**Hint & Sol:**

1	0	7
un	nil	sept

Hence IUPAC name is Unnilseptium

72. Answer (2)

**Hint:** Ionisation energy of cation is more than atom for a particular element.

**Sol.:** In case of isoelectronic species, ionisation energy increases with increase in atomic number.

73. Answer (4)

**Hint:** Halogen has negative electron gain enthalpy.

**Sol.:** F has less negative electron gain enthalpy than Cl due to its smaller size and high charge density.

74. Answer (3)

**Hint & Sol:** Germanium is Eka silicon.

75. Answer (4)

**Hint:** : Electronegativity increases on moving left to right along a period.

**Sol.:** : Fluorine is most electronegative element of periodic table.

76. Answer (3)

**Hint:**  $\Delta H = \Delta U + \Delta nRT$

**Sol.:**  $\Delta G = \Delta H - T\Delta S$

=  $2.1 + 2 \times 2 \times 10^{-3} \times 300 - 300 \times 20 \times 10^{-3}$

=  $-2.7 \text{ kcal}$

77. Answer (2)

$$\text{Hint: } \Delta S = nR \ln \left( \frac{V_2}{V_1} \right)$$

**Sol.:**  $n = 1$ 

$$V_1 = 5 \text{ L}; V_2 = 50 \text{ L}$$

$$\begin{aligned} \therefore \Delta S &= nR \ln \left( \frac{V_2}{V_1} \right) \\ &= 2.303nR \log \left( \frac{V_2}{V_1} \right) \\ &= 2.303 \times 1 \times R \times \log \left( \frac{50}{5} \right) \\ &= 2.303R \end{aligned}$$

78. Answer (2)

$$\text{Hint: } \Delta S = \frac{q_{\text{rev}}}{T}$$

**Sol.:** For vaporisation

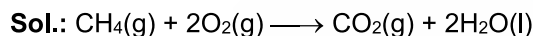
$$\Delta S = \frac{\Delta_{\text{vap}} H^\circ}{T} = \frac{0.5 \times 40.66 \times 10^3}{373} = 54.5 \text{ JK}^{-1}$$

79. Answer (1)

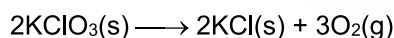
**Hint:** Entropy decreases when moles of gaseous product are less than moles of gaseous reactant.

$$\Delta n_g = -ve \Rightarrow \Delta S = -ve$$

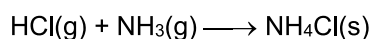
$$\Delta n_g = +ve \Rightarrow \Delta S = +ve$$



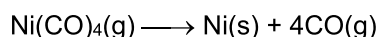
$$\Delta n_g = 1 - 3 = -2$$



$$\Delta n_g = 3$$



$$\Delta n_g = 0 - 2 = -2$$



$$\Delta n_g = 4 - 1 = 3$$

80. Answer (4)

**Hint:** At equilibrium,  $\Delta G = 0$ 

$$\text{Sol.: } \Delta G = \Delta H - T\Delta S$$

$$0 = \Delta H - T\Delta S$$

$$T = \frac{\Delta H}{\Delta S} = \frac{90 \times 1000}{300} = 300 \text{ K} = 27^\circ\text{C}$$

81. Answer (2)

**Hint:** For spontaneous process,

$$\Delta G = -ve$$

$$\text{Sol.: } \Delta G = \Delta H - T\Delta S$$

When  $\Delta H$  and  $\Delta S$  both are greater than zero, reaction is spontaneous at high temperature.

82. Answer (4)

**Hint:** Those physical properties which depend on the amount of matter present in a system are called extensive properties.**Sol.:** Intensive properties – temperature, pressure, density

Extensive property – volume

83. Answer (4)

**Hint:** In a cyclic process initial and final states coincide.**Sol.:** In a cyclic process change in  $T$ ,  $P$ ,  $V$ ,  $U$ ,  $H$  are zero as initial and final states coincide with each other.

84. Answer (3)

**Hint:** Work done during expansion of a gas against a constant pressure is given as

$$W = -P_{\text{ext}}(V_f - V_i)$$

$$\text{Sol.: } W = -1(1 - 0.5) \text{ L bar}$$

$$= -0.5 \text{ L bar} = -0.5 \times 100 \text{ J} = -50 \text{ J}$$

85. Answer (2)

**Hint: & Sol.:** Sublimation process is direct conversion of a solid directly into gaseous state without undergoing liquid state at constant temperature and standard pressure enthalpy change in this process is enthalpy of sublimation denoted by  $\Delta_{\text{sub}}H^\ominus$ **SECTION - B**

86. Answer (2)

**Hint: & Sol.:** Thermodynamically most stable state of oxygen is  $\text{O}_2(\text{g})$ .

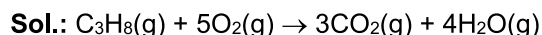
87. Answer (4)

$$\text{Hint: } \Delta G = \Delta H - T\Delta S$$

$$\begin{aligned} \text{Sol.: } \Delta G &= -20 \times 10^3 - 300 \times 30 \\ &= -29 \times 10^3 \text{ J} = -29 \text{ kJ} \end{aligned}$$

88. Answer (3)

$$\text{Hint: } q_p = q_v + \Delta n_g RT$$



$$\Delta H = \Delta U + \Delta n_g RT$$

$$\Delta n_g = 1$$

$$\Delta H = -30 \times 10^3 + 1 \times 8.314 \times 400 = -26.67 \text{ kJ}$$

89. Answer (3)

**Hint:** Atomic Number of mendeleevium is 101.**Sol.:** IUPAC official name      Atomic number

Nobelium                      102

Mendeleevium                101

Dubnium                        105

Bohrium                        107

90. Answer (2)

**Hint:** According to first law of thermodynamics ;  
 $\Delta U = q + w$

**Sol.:**  $\Delta U = q + w$

$$\Delta U = +70 + (-150)$$

$$= -80 \text{ J}$$

91. Answer (1)

**Hint:** Hybridisation of carbon in  $\text{CO}_2$  is  $sp$

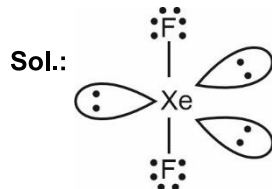
**Sol.:** Hybridisation of xenon in  $\text{XeF}_4$  is  $sp^3d^2$

Hybridisation of iodine in  $\text{IF}_7$  is  $sp^3d^3$

Hybridisation of iodine in  $\text{I}_3^+$  is  $sp^3$

92. Answer (3)

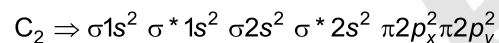
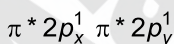
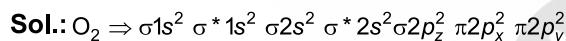
**Hint:** Xe is  $sp^3d$  hybridised with 3 lone pair of electron on central Xe atom in  $\text{XeF}_2$



Total number of lone pair of electrons = 9

93. Answer (4)

**Hint:** Electrons responsible for bonding in  $\text{C}_2$  are present in  $\pi$ -bonding molecular orbitals.

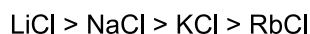


Hence  $\text{O}_2$  will have 1  $\sigma$  and 1  $\pi$  bond while  $\text{C}_2$  will have both  $\pi$  bonds.

94. Answer (4)

**Hint:** Ionic compounds with smaller cation and high charge density tend to have more covalent character.

**Sol.:** Order of covalent nature.



95. Answer (4)

**Hint :** Hg has its atomic number,  $Z = 80$ .

**Sol.:** Hg belongs to 12<sup>th</sup> group and 6<sup>th</sup> period

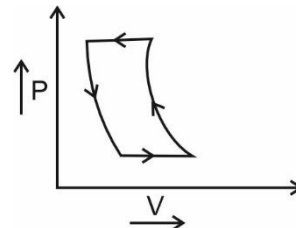
96. Answer (1)

**Hint:** For isothermal process temperature is constant during the process.

**Sol.:**

- For a cyclic process initial and final states are same.
- During isothermal expansion pressure drops while during isothermal compression pressure will rise.
- During isobaric expansion volume will increase by keeping pressure constant.

Hence correct PV graph will be



97. Answer (4)

**Hint:** Elements with atomic number more than that of uranium are transuranium elements.

**Sol.:** Lawrencium (Lr) is transuranium element.

98. Answer (2)

**Hint:**  $\Delta H - \Delta U = \Delta n_g RT$

**Sol.:**  $\Delta n_g = 2 - \left(1 + \frac{5}{2}\right)$

$$= 2 - \frac{7}{2} = \frac{-3}{2}$$

$$\therefore \Delta H - \Delta U = \Delta n_g RT = -\frac{3}{2} RT$$

99. Answer (3)

**Hint:**  $\Delta G^\circ = -2.303 RT \log K$

**Sol.:**  $K = 2 \times 10^3$

$$T = 25^\circ\text{C} = 298 \text{ K}$$

$$\Delta G^\circ = -2.303 \times R \times 298 \times \log (2 \times 10^3)$$

$$= -2.303 R \times 298 \times 3.3$$

$$= -7.6 \times 298 \times R$$

100. Answer (2)

**Hint:** Absolute zero temperature means 0 kelvin

**Sol.:** At absolute zero temperature molecular motion of perfectly crystalline substances ceases.

**[BOTANY]****SECTION-A**

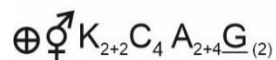
101. Answer (3)

**Hint:** In mango and coconut, the fruit is known as drupe and they develop from monocarpellary superior ovaries.

**Sol.:** In mango, the pericarp is well differentiated into an outer thin epicarp, a middle fleshy edible mesocarp. In coconut mesocarp is fibrous.

102. Answer (2)

**Hint:** The floral formula for mustard is



**Sol.:** Mustard flower possess superior ovary in which gynoecium occupies the highest position while other parts are situated below it.

103. Answer (4)

**Hint:** Members of Fabaceae family show diadelphous androecium.

**Sol.:** China rose shows monadelphous condition.

104. Answer (3)

**Hint:** Pneumatophore roots come out of the ground and grow vertically upward in plants growing in swampy areas.

**Sol.:** Pneumatophores help to get oxygen for respiration and they show negative geotropism.

105. Answer (2)

**Hint:** Keel is the two smallest anterior petals of the flower showing vexillary aestivation.

**Sol.:** In flower of *Indigofera*, corolla consist of a posterior standard, two lateral wings, two anterior ones forming a keel which encloses stamens and pistils.

106. Answer (1)

**Hint:** The cells proximal to the region of meristematic activity form region of elongation.

**Sol.:** Cells in the region of elongation are responsible for the growth of root in length.

107. Answer (4)

**Hint:** In gourds, stems are modified into tendrils and help plants to climb.

**Sol.:** In pea, leaves are converted into tendrils for climbing.

108. Answer (3)

**Hint:** In cymose type of inflorescence the flowers are borne in a basipetal order.

**Sol.:** *Solanum* shows cymose inflorescence.

109. Answer (2)

**Hint:** Fibrous root system is observed in wheat plant.

**Sol.:** In wheat plant, the primary root is short lived and replaced by a large number of roots and these roots originate from base of the stem.

110. Answer (4)

**Hint:** If more than two leaves arise at a node and form a whorl, then it is called whorled phyllotaxy.

**Sol.:** *Alstonia* shows whorled phyllotaxy.

111. Answer (3)

**Hint:** Plant tissues devoid of protoplast are dead.

**Sol.:** Phelloderm or secondary cortex develops during the secondary growth. It has thin walled parenchymatous cells. These are living cells and possess cellulosic cell wall.

112. Answer (2)

**Hint:** In spring season, cambium is very active.

**Sol.:** In spring wood, large number of xylary elements having vessels with wider cavity is present. It is lighter in colour and has lower density.

113. Answer (3)

**Hint:** Next to endodermis lies a few layers of thick walled parenchymatous cells referred to as pericycle.

**Sol.:** Initiation of lateral roots and vascular cambium during the secondary growth of dicot roots takes place with the help of pericycle.

114. Answer (4)

**Hint:** Cork cambium is an example of lateral meristem.

**Sol.:** Sclerenchymatous cells are present in the walls of fruit. Collenchyma provides support to the growing parts of the plant. Cork cambium is responsible for producing secondary tissues. Parenchyma is simple permanent tissue and it forms the major component within the organ.

115. Answer (2)

**Hint:** In dicot stem, pericycle is present on the inner side of the endodermis and above the phloem in the form of semilunar patches of sclerenchyma.

**Sol.:** In dicot stem, cortical layers below hypodermis consist of rounded thin walled parenchymatous cells with conspicuous intercellular spaces.

116. Answer (2)

**Hint:** Large and colourless cells are present in adaxial epidermal cells of grass leaves (monocot).

**Sol.:** Bulliform cells in monocot become flaccid due to water stress and make the grass leaves curl inwards to minimise water loss.

117. Answer (3)  
**Hint:** All the tissues except epidermis and vascular bundle constitute the ground tissue.  
**Sol.:** Subsidiary cells are epidermal cells.
118. Answer (2)  
**Hint:** Sieve tube and companion cells are component of phloem they are absent in gymnosperm.  
**Sol.:** Vessels are found in angiosperms. Vessels are characteristic feature of angiosperm.
119. Answer (4)  
**Hint:** Protoxylem and metaxylem are two types of primary xylem.  
**Sol.:** In roots, the protoxylem lies towards periphery and metaxylem lies towards centre. Such arrangement of primary xylem is called exarch.
120. Answer (3)  
**Hint:** In *Dianthus* and Primrose, ovules are borne on the central axis and septa are absent.  
**Sol.:** In *Dianthus* and Primrose, the placentation is called free central.
121. Answer (1)  
**Hint:** When shoot apical meristem changes to floral meristem, internode do not elongate and the axis get condensed.  
**Sol.:** The apex produces different kinds of floral appendages laterally at successive nodes instead of leaves.
122. Answer (2)  
**Hint:** Papilionaceous corolla, is found in the members of Fabaceae.  
**Sol.:** Tulip is the member of Liliaceae family in which perianth is present.
123. Answer (4)  
**Hint:** In zygomorphic symmetry, flowers can be divided into two similar halves only in one vertical plane.  
**Sol.:** Flowers of pea, gulmohur and sunhemp show zygomorphic symmetry.
124. Answer (2)  
**Hint:** Brassicaceae –  $\oplus \text{K}_{2+2} \text{C}_4 \text{A}_{2+4} \underline{\text{G}}_{(2)}$   
 Fabaceae –  $\% \text{K}_{(5)} \text{C}_{1+2+(2)} \text{A}_{(9)+1} \underline{\text{G}}_1$   
 Solanaceae –  $\oplus \text{K}_{(5)} \text{C}_{(5)} \text{A}_5 \underline{\text{G}}_{(2)}$   
 Liliaceae –  $\text{Br} \oplus \text{P}_{(3+3)} \text{A}_{3+3} \underline{\text{G}}_{(3)}$   
**Sol.:** Mustard – Brassicaceae  
 Groundnut – Fabaceae  
 Onion – Liliaceae  
 Tobacco – Solanaceae
125. Answer (3)  
**Hint:** In brinjal, hypogynous flowers are present.  
**Sol.:** In brinjal, gynoecium occupies the highest position while other parts are situated below it. The ovary is said to be superior. e.g, mustard, China rose, brinjal.
126. Answer (1)  
**Sol.:** In dicot stem, the cells of cambium present between primary xylem and primary phloem is intrafascicular cambium.
127. Answer (3)  
**Hint:** In dicot leaf abaxial epidermis generally bears more stomata than the adaxial epidermis.  
**Sol.:** In dicot leaf, the vascular bundles are surrounded by layer of thick walled bundle sheath cells.
128. Answer (2)  
**Hint:** Companion cells are parenchymatous cells and closely associated with sieve tube elements.  
**Sol.:** Xylem parenchyma stores substances like tannins. Vessels are made up of many cells and they are interconnected through perforations in their walls. Phloem parenchyma is absent in most of monocot plants.
129. Answer (4)  
**Hint:** All the tissues outside the vascular cambium constitute the bark.  
**Sol.:** Bark consists of periderm, primary cortex, pericycle, primary and secondary phloem.
130. Answer (2)  
**Hint:** Phellogen, phellem and phelloderm are collectively known as periderm.  
**Sol.:** Cork cambium (Phellogen), cork (phellem) and secondary cortex (Phelloderm) are collectively known as periderm.
131. Answer (3)  
**Hint:** Primary meristem contributes to formation of primary plant body.  
**Sol.:** Both apical and intercalary meristems are primary meristems because they appear early in life of a plant and contribute to the formation of the primary plant body.
132. Answer (2)  
**Hint:** Tulip is a member of Liliaceae family.  
**Sol.:** Tulip shows valvate aestivation of perianth.
133. Answer (1)  
**Hint:** Tomato belongs to Solanaceae family.  
**Sol.:** In tomato, gynoecium shows syncarpous condition as the carpels are fused.

134. Answer (4)

**Hint:** It is an aquatic plant.

**Sol.:** In aquatic plant like *Pistia* and *Eichhornia*, a lateral branch with short internodes and each node bearing rosette of leaves and tuft of roots, is present.

135. Answer (2)

**Hint:** In floral formula, corolla is represented by C.

**Sol.:** In floral formula, calyx is represented by K.

### SECTION-B

136. Answer (3)

**Hint:** This layer is not a part of stele.

**Sol.:** The cells of the endodermis in dicot stem are rich in the starch grain and is also referred to as the starch sheath.

137. Answer (4)

**Hint:** The trichome in the shoot system are usually multicellular.

**Sol.:** Root hair and trichomes are epidermal appendages.

138. Answer (2)

**Hint:** In dicot leaf, mesophyll is differentiated into two types of cells.

**Sol.:** In monocot leaf, like maize leaf, mesophyll is not differentiated into palisade and spongy parenchyma.

139. Answer (2)

**Hint:** Stems of a particular plant group have water containing cavities.

**Sol.:** Water containing cavities are present within the vascular bundles of monocot stem.

140. Answer (2)

**Hint:** The conjoint vascular bundles are commonly found in stems and leaves.

**Sol.:** In conjoint type of vascular bundles, xylem and phloem are jointly situated along the same radius of the vascular bundle.

141. Answer (4)

**Hint:** Innermost layer of cortex is not a part of stele.

**Sol.:** All tissues on the inner side of the endodermis such as pericycle, vascular bundle and pith constitute the stele.

142. Answer (3)

**Hint:** Cells of cambium cut off towards pith mature into secondary xylem and the cells cut off towards periphery mature into secondary phloem.

**Sol.:** The correct sequence of the tissues in the stem showing secondary growth from pith towards cortex is as follows.

Primary xylem → Secondary xylem → Secondary phloem → Primary phloem.

143. Answer (4)

**Hint:** All of the given characteristics are observed in members of Solanaceae family.

**Sol.:** Chilli is a member of Solanaceae family. It exhibits all the mentioned features.

144. Answer (2)

**Hint:** In some plant primary tap root or adventitious root get modified to store food.

**Sol.:** Adventitious roots of sweet potato get swollen and store food.

In turnip, carrot and beet, the primary tap root is modified to store food.

145. Answer (3)

**Hint:** Androecium with  $A_{3+3}$  condition is observed in members of Liliaceae.

**Sol.:** *Gloriosa* is an ornamental plant belonging to Liliaceae family.

146. Answer (1)

**Hint:** Castor is a dicot plant.

**Sol.:** In castor seed, two cotyledons are present. Monocot seeds have one large and shield shaped cotyledon known as scutellum.

147. Answer (4)

**Hint:** Lily family is a representative of monocotyledonous plants.

**Sol.:** *Asparagus* is a member of Liliaceae family and it is a monocot plant.

148. Answer (2)

**Hint:** Roots in carrot or turnip get modified to store food.

**Sol.:** Roots do not possess nodes and internodes.

149. Answer (3)

**Hint:** Aggregate fruits develop from polycarpellary, apocarpous ovary.

**Sol.:** Simple fruits develop from the syncarpous ovary of the single flower with or without accessory parts.

150. Answer (2)

**Hint:** Prop roots are hanging roots coming out from branches of banyan tree for support.

**Sol.:** The stems of maize and sugarcane have supporting roots coming out of lower nodes of the stem called stilt roots.

**[ZOOLOGY]****SECTION - A**

151. Answer (3)

**Hint:** Increase in heart beat leads to change in cardiac output

**Sol.:** Parasympathetic neural signals decrease the rate of heart beat, speed of conduction of action potentials, thereby the cardiac output. Adrenal medullary hormones can also increase the cardiac output. The electrical activity of the heart can be recorded from the body surface by using electrocardiograph and the graphical representation of the electrical activity of the heart during a cardiac cycle is called electrocardiogram (ECG) which is of great clinical importance.

152. Answer (3)

**Hint:** QRS complex represents the depolarisation of ventricles.

**Sol.:** Atrial diastole starts when ventricles undergo contraction. The QRS complex represents the depolarisation of the ventricles, which initiates the ventricular contraction. The T-wave represents the return of the ventricles from excited to normal state (repolarisation). The end of T-wave marks the end of the systole.

153. Answer (4)

**Hint:** It carries the deoxygenated blood.

**Sol.:** The deoxygenated blood pumped by the right ventricle enters into the pulmonary artery, whereas the left ventricle pumps oxygenated blood into the aorta. The deoxygenated blood pumped into pulmonary artery is passed on to the lungs. Superior vena cava and inferior vena cava carry deoxygenated blood from the body and pour it in the right auricle of the heart.

154. Answer (2)

**Hint:** Intake of O<sub>2</sub> and removal of CO<sub>2</sub>

**Sol.:** The systemic circulation provides nutrients, O<sub>2</sub> and other essential substances to the tissues and takes CO<sub>2</sub> and other harmful substances away for elimination.

155. Answer (4)

**Hint:** Equal to the number of layers present in diffusion membrane at alveolar site

**Sol.:** The glomerular capillary blood pressure causes filtration of blood through 3 layers, i.e. the endothelium of glomerular blood vessels, the epithelium of Bowman's capsule and a basement membrane between these two layers.

156. Answer (1)

**Hint:** Deficiency of RBCs in foetal blood

**Sol.:** Rh incompatibility could be fatal to the foetus or could cause severe anaemia and jaundice to the baby. This condition is called erythroblastosis foetalis. This can be avoided by administering anti - Rh antibodies to the Rh -ve mother immediately after the delivery of the first Rh +ve child.

157. Answer (3)

**Hint:** Annelids and chordates have a closed circulatory system.

**Sol.:** All vertebrates possess a muscular, chambered heart. Amphibians and the reptiles (except crocodiles) have a 3-chambered heart with two atria and single ventricle, whereas crocodiles and birds possess a 4-chambered heart. Human heart has the size of a clenched fist. Erythroblastosis foetalis can be avoided by administering anti-Rh antibodies to the Rh -ve mother immediately after the delivery of the first Rh +ve child.

158. Answer (1)

**Hint:** ADH increases the blood pressure and GFR.

**Sol.:** Juxtaglomerular apparatus is a special sensitive region formed by cellular modifications in the DCT and afferent arteriole at the location of their contact. A fall in GFR can activate the JG cells to release renin which can stimulate the glomerular blood flow and thereby the GFR back to normal. Aldosterone causes reabsorption of Na<sup>+</sup> and water from the distal parts of tubule.

159. Answer (2)

**Hint:** Number of bones in each upper limb in humans

**Sol.:** On an average, 25-30 gm of urea is excreted out per day by an adult man under normal physiological conditions.

160. Answer (4)

**Hint:** Universal recipients

**Sol.:** Person with 'AB' blood group can accept blood from person with AB as well as the other groups of blood. Therefore, such persons are called 'universal recipients'.

161. Answer (3)

**Hint:** Stroke volume multiplied by heart rate gives the cardiac output.

**Sol.:** The stroke volume multiplied by heart rate can be defined as the volume of blood pumped out by each ventricle per minute (Cardiac output).

Cardiac output (CO) = Stroke volume (SV) × Number of heart beats per minute

Stroke volume = 75 mL

Heart rate = 100 beats/min

$\therefore$  CO = 100  $\times$  75 mL/min

Cardiac output is 7500 mL/min.

162. Answer (2)

**Hint:** Average beats are 72 times  $\text{min}^{-1}$ .

**Sol.:** The SAN can generate the maximum number of action potentials, *i.e.*, 70-75  $\text{min}^{-1}$  and is responsible for initiating and maintaining the rhythmic contractile activity of the heart. Therefore, it is called the pacemaker. Our heart normally beats 70-75 times in a minute.

163. Answer (1)

**Hint:** Stroke volume

**Sol.:** During a cardiac cycle, each ventricle pumps out approximately 70 mL of blood which is called the stroke volume. The stroke volume multiplied by the heart rate (number of beats per minute) gives the cardiac output. Therefore, the cardiac output can be defined as the volume of blood pumped out by each ventricle per minute and averages 5000 mL or 5 litres in a healthy individual.

164. Answer (2)

**Hint:** Activation of RAAS

**Sol.:** The JGA plays a complex regulatory role. A fall in glomerular blood flow/GFR can activate the JG cells to release renin which converts angiotensinogen in blood to angiotensin I and further to angiotensin II. Angiotensin II, being a powerful vasoconstrictor, increases the glomerular blood pressure and thus, GFR. An increase in blood flow to the atria of heart can cause the release of ANF.

165. Answer (1)

**Hint:** Heart is the pumping organ.

**Sol.:** Heart failure means the state of heart when it is not pumping blood effectively enough to meet the needs of the body. It is sometimes called congestive heart failure because congestion of lungs is one of the main symptoms of this disease. High blood pressure leads to heart diseases and also affects vital organs like brain and kidney.

166. Answer (1)

**Hint:** Sometimes called congestive heart failure

**Sol.:** **Heart failure** means the state of heart when it is not pumping blood effectively enough to meet the needs of the body

**Cardiac arrest** – When the heart stops beating

**Heart attack** – When the heart muscles is suddenly damaged by an inadequate blood supply.

**Angina pectoris** – Acute chest pain appears when no enough oxygen is reaching the heart muscles.

167. Answer (2)

**Hint:** Concave surface of the kidney

**Sol.:** Towards the centre of the inner concave surface of the kidney is a notch called hilum

through which ureter, blood vessels and nerves enter. Inner to the hilum is a broad funnel shaped space called the renal pelvis with projections called calyces. The inner part of kidney has two parts *i.e.*, cortex and medulla. The medulla is divided into a few medullary pyramids.

168. Answer (3)

**Hint:** Identify a granulocyte.

**Sol.:** Neutrophils and monocytes are phagocytic cells which destroy foreign organisms entering the body. Basophils secrete histamine, serotonin, heparin *etc.*, and are involved in inflammatory reactions. Eosinophils resist infections and are also associated with allergic reactions. Lymphocytes are of two major types 'B' and 'T'. Both 'B' and 'T' lymphocytes are responsible for immune responses of the body.

169. Answer (4)

**Hint:** Atrio-ventricular valves of both sides of the heart.

**Sol.:** The first heart sound (lub) is associated with the closure of the tricuspid and bicuspid valves whereas the second heart sound (dub) is associated with the closure of the semilunar valves. These heart sounds are of clinical diagnostic significance.

170. Answer (4)

**Hint:** Medulla oblongata can moderate the cardiac functions through ANS.

**Sol.:** The body has the ability to alter the stroke volume as well as the heart rate and thereby the cardiac output, for example the cardiac output of an athlete will be much higher than that of an ordinary man.

171. Answer (1)

**Hint:** Uremia leads to renal failure.

**Sol.:** Malfunctioning of kidneys can lead to accumulation of urea in blood, a condition called uremia, which is highly harmful and may lead to kidney failure.

Renal calculi - Stone or insoluble mass of crystallised salts (oxalates) formed within the kidney.

Glomerulonephritis – Inflammation of glomeruli of kidney.

172. Answer (2)

**Hint:** Dialysing fluid contains all of the components of plasma except urea.

**Sol.:** In haemodialysis, the blood drained from a convenient artery is pumped into a dialysing unit. The unit contains a coiled cellophane tube surrounded by a fluid having the same composition as that of plasma except the nitrogenous wastes.

The porous cellophane membrane of tubes allows the passage of molecules based on concentration gradient. As nitrogenous wastes are absent in the dialysing fluid, these substances freely move out, thereby clearing the blood.

173. Answer (3)

**Hint:** It secretes heparin and serotonin.

**Sol.:** Neutrophils are the most abundant cells (60-65 per cent) of the total WBCs and basophils are the least (0.5-1 per cent) among them. Neutrophils and monocytes (6-8 per cent) are phagocytic cells which destroy foreign organisms entering the body. Basophils secrete histamine, serotonin, heparin, etc. and are also involved in inflammatory reactions. Eosinophils (2-3 per cent) resist infections and are also associated with allergic reactions.

174. Answer (1)

**Hint:** Plasma contains minerals and lipids.

**Sol.:** Plasma contains small amounts of minerals like  $\text{Na}^+$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{HCO}_3^-$ ,  $\text{Cl}^-$  etc. Glucose, amino acids, lipids, etc, are also present in the plasma as they are always in transit in the body.

175. Answer (2)

**Hint:** Clear liquid part of blood

**Sol.:** Plasma without the clotting factors is called serum. Fibrinogens are needed for clotting or coagulation of blood. Globulins are primarily involved in defense mechanisms of the body and the albumins help in osmotic balance.

176. Answer (1)

**Hint:** Antennal gland

**Sol.:** Malpighian tubules are the excretory structures of most of the insects including cockroaches. Antennal glands or green glands perform the excretory function in crustaceans like prawns. Nephridia are the tubular excretory structures of earthworms and other annelids. Vertebrates have complex tubular organs called kidneys. Malpighian body is the part of nephron which is present in the kidneys.

177. Answer (4)

**Hint:** Ascending and descending limbs help in it

**Sol.:** Henle's loop - Reabsorption is minimum in its ascending limb however, this region plays a significant role in the maintenance of high osmolarity of medullary interstitial fluid. 70-80 per cent of electrolytes and water are reabsorbed in PCT. Conditional reabsorption of  $\text{Na}^+$  and water takes place in the DCT. Collecting duct also plays an important role in maintenance of pH and ionic balance of body by selective secretion of  $\text{H}^+$  and  $\text{K}^+$  ions.

178. Answer (1)

**Hint:** Function of CD

**Sol.:** PCT is lined by simple cuboidal brush border epithelium. Nearly all of the essential nutrients and 70-80 percent of electrolytes and water are reabsorbed by this segment. PCT also helps to maintain the pH and ionic balance of the body fluids by selective secretion of hydrogen ions, and ammonia into the filtrate and by absorption of  $\text{HCO}_3^-$  from it.

Collecting duct allows passage of small amounts of urea into the medullary interstitium to keep up the osmolarity.

179. Answer (2)

**Hint:** Possesses podocytes

**Sol.:** The renal tubule begins with a double walled cup-like structure called Bowman's capsule, which encloses the glomerulus. Glomerulus along with Bowman's capsule is called Malpighian body or renal corpuscle. The tubule continues further to form a highly coiled network-proximal convoluted tubule. The cortex extends in between the medullary pyramids as renal columns called columns of Bertini.

180. Answer (1)

**Hint:** Can generate maximum number of action potentials

**Sol.:** The SAN can generate the maximum number of action potentials, i.e.  $70-75 \text{ min}^{-1}$ , and is responsible for initiating and maintaining the rhythmic contractile activity of heart. A bundle of nodal fibres, AV bundle continues from AVN which passes through the atrio-ventricular septa to emerge on the top of the interventricular septum and immediately divides into a right and left bundle. These branches give rise to minute fibres throughout the ventricular musculature of the respective sides and are called Purkinje fibers. The nodal musculature has the ability to generate action potentials without any external stimuli, i.e., it is autoexcitable.

181. Answer (4)

**Hint:** Equals to number of metacarpals in both hands of man

**Sol.:** Each kidney of an adult human measures 10-12 cm in length, 5-7 cm in width, 2-3 cm in thickness with an average weight of 120-170 gm.

182. Answer (3)

**Hint:** 12<sup>th</sup> thoracic vertebra

**Sol.:** In humans, kidneys are situated between the levels of last thoracic and third lumbar vertebra close to the dorsal inner wall of the abdominal cavity.

183. Answer (3)

**Hint:** Metamerically segmented animals

**Sol.:** Protonephridia or flame cells are the excretory structures in platyhelminths (flatworms, e.g. *Planaria*), rotifers, some annelids and the cephalochordates such as *Amphioxus*.

184. Answer (3)

**Hint:** Four chambered heart

**Sol.:** Fishes have a 2-chambered heart with an atrium and a ventricle. Reptiles (except crocodiles) have 3-chambered heart with two atria and a single ventricle whereas crocodiles, birds and mammals possess a 4-chambered heart with two atria and two ventricles. Two separate circulatory pathways are present in birds, crocodiles and mammals, hence these animals exhibit double circulation.

185. Answer (4)

**Hint:** Occurs at the beginning of ventricular diastole

**Sol.:** During ventricular systole, ventricular pressure increases further due to which the semilunar valves guarding the pulmonary artery and the aorta are forced open, allowing the blood in the ventricles to flow through these vessels into the circulating pathways. The ventricles now relax (ventricular diastole) and the ventricular pressure falls causing the closure of the semilunar valves which prevents the backflow of blood into the ventricles.

**SECTION - B**

186. Answer (2)

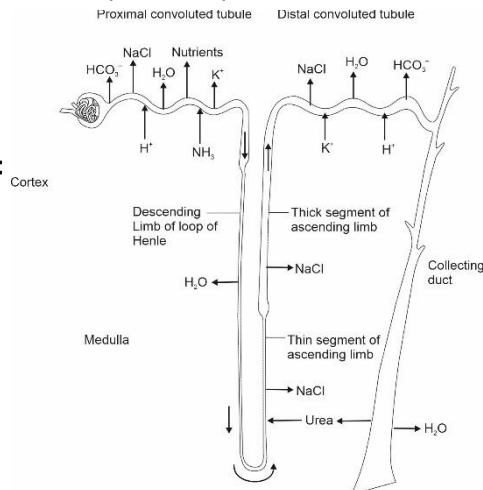
**Hint:** Identify the function of cell fragments present in the blood

**Sol.:** Dark reddish brown scum formed at the site of a cut or an injury over a period of time. It is a clot or coagulum formed mainly of a network of thread called fibrins in which dead and damaged formed elements of blood are trapped. Precipitation occurs during interaction between antibodies and antigens.

187. Answer (3)

**Hint:** Not the part of nephron

**Sol.:**



188. Answer (3)

**Hint:** Equals to the total number of bones in pectoral girdle

**Sol.:** Human kidneys can produce urine nearly four times concentrated than the initial filtrate formed.

189. Answer (1)

**Hint:** ADH increases blood pressure

**Sol.:** ADH can also affect the kidney function by its constrictory effect on blood vessels. This causes an increase in blood pressure. An increase in blood pressure can increase the glomerular blood flow and thereby the GFR.

190. Answer (3)

**Hint:** Produced by atria of the heart

**Sol.:** An increase in blood flow to the atria of the heart can cause the release of ANF. ANF can cause vasodilation and thereby decreases the blood pressure. ANF mechanism acts as a check on the renin-angiotensin mechanism.

191. Answer (2)

**Hint:** Excreted via sebum

**Sol.:** Sweat produced by the sweat glands is a watery fluid containing NaCl, small amounts of urea, lactic acid, etc. Sterols are present in sebum.

192. Answer (4)

**Hint:** Uremia leads to renal failure.

**Sol.:** Presence of ketone bodies in urine is called ketonuria. Malfunctioning of kidney can lead to accumulation of urea in blood, a condition called uremia, which is highly harmful and may lead to kidney failure.

193. Answer (4)

**Hint:** Its level in blood is regulated by parathyroid hormone.

**Sol.:** Calcium ions play a very important role in clotting of blood.

194. Answer (3)

**Hint:** Tricuspid valves are partially open

**Sol.:** Tricuspid valves are partially open because of the damaged chordae tendinae attached to right atrium. In such case, blood will tend to flow back into right atrium which leads to decrease the blood flow in the pulmonary artery.

195. Answer (3)

**Hint:** Composition of plasma

**Sol.:** Lymph has the same mineral distribution as that in plasma. Exchange of nutrients, gases, etc, between blood and the cells always occurs through this fluid. Lymph is a colourless fluid containing specialised lymphocytes which are responsible for immune responses of the body. Lymph is also an important carrier for nutrients, hormones, etc. Fats are absorbed through lymph in the lacteals present in the intestinal villi.

196. Answer (1)

**Hint:** Glucose and amino acids are reabsorbed actively.

**Sol.:** The tubular epithelial cells in different segments of nephron perform reabsorption either by active or passive mechanisms. For example, substances like glucose, amino acids,  $\text{Na}^+$ , etc., in the filtrate are reabsorbed actively whereas the nitrogenous wastes are absorbed by passive transport. Reabsorption of water also occurs passively in the initial segments of the nephron.

197. Answer (2)

**Hint:** Above systolic blood pressure

**Sol.:** On an average, 1100-1200 mL of blood is filtered by the kidneys per minute. GFR in a healthy individual is approximately 125 mL/minute *i.e.*, 180 litres per day. A comparison of volume of the filtrate formed per day (180 litres per day) with that of urine released (1.5 litre), suggest that nearly 99 per cent of the filtrate has to be reabsorbed by the renal tubules.

198. Answer (2)

**Hint:** Rh +ve father

**Sol.:** A special case of Rh incompatibility has been observed between the Rh -ve blood of a pregnant mother with Rh +ve blood of the foetus.

199. Answer (2)

**Hint:** Collecting duct also helps in the maintenance of pH and ionic balance of body.

**Sol.:** Descending limb of loop of Henle is permeable to water but almost impermeable to electrolytes. The ascending limb is impermeable to water but allows transport of electrolytes actively or passively. Collecting duct allows passage of small amounts of urea into the medullary interstitium to keep up the osmolarity.

200. Answer (3)

**Hint:** 140/90 shows hypertension.

**Sol.:** Hypertension is the term used for blood pressure that is higher than normal (120/80 mmHg) after repeated checks. In this measurement 120 mm Hg is the systolic, or pumping pressure and 80 mm Hg is the diastolic or resting pressure.

